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No. CCVI.

SEPTEMBER 1, 1881.

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THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

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TELEGRAPHIC JOURNAL

AND

ELECTRICAL REVIEW.

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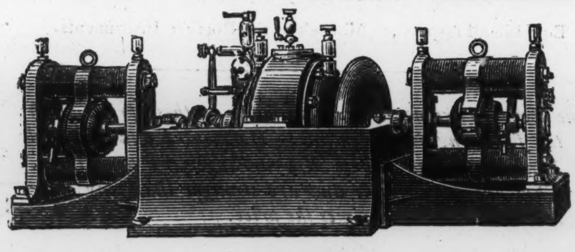

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PATENT 3-CYLINDER ENGINES
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FOR DRIVING
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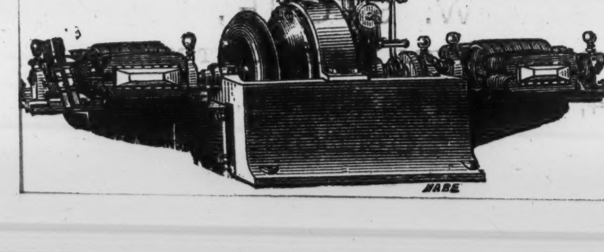


THE TELEGRAPHIC JOURNAL AND
ELECTRICAL REVIEW.
VOL. IX.—NO. 206.

THE PARIS ELECTRICAL EXHIBITION.

IT has been said that the Paris Electrical Exhibition lacks interest on the score of novelty, for at the present day, when intercourse and intercommunication between the various countries which form the civilised portion of the globe is so comparatively easy, novelties cease to be novelties within almost a few days after their publication in the country of their origin. This is true to a very great extent, but at the same time it is not universally the case; several European countries, about which but comparatively little is heard, have practically been considered to be quite in the rear of the progressive march of electrical science. The Electrical Exhibition has, however, quite dispelled this illusion; take, for instance, Norway and Sweden: in both these countries electrical and telegraphic exhibits are shown which will yield the palm to no other country in respect of ingenuity or mechanical design. In the Swedish Department, one of the most prominent exhibits, and perhaps the most ingenious exhibit in the whole exhibition, is the "Theorell Printing Meteorograph." Meteorological observations are shown by this instrument on tables printed on a slip of paper. Of six tabular columns, the first gives the hours; the second, the velocity of the wind; the third, the direction of the same; the fourth, the temperature; the fifth, the degree of humidity, according to August's method, by the wet and dry bulb thermometers; and the sixth, the atmospheric pressure, which is given in millimetres. The degrees of the thermometer employed are those of the centigrade scale, and negative degrees are expressed by their complements of 100. The direction of the wind is indicated by figures from 1 to 32. The numbers expressing the velocity of the wind signify metres in a second. The registration takes place by means of electrical currents, which are closed in the barometer and both the thermometers by contact between the mercury and steel wires that descend into their tubes, and at the weather-cock and anemometer by contact between a metal knob, which is put into motion by the current, and a wheel which is in direct mechanical combination with each of these instruments. The steel wires in the barometer and in both the thermometers are connected, each by its respective system of brass wheels, with numerical types, engraved on the edges in such a manner that the rotation of the wheels causes an upward or downward motion of the steel wires, so that the point of the scale on which the lower extremity of the wire is situated is necessarily that indicated by the number appearing at the same moment uppermost on the corresponding wheels. The two other

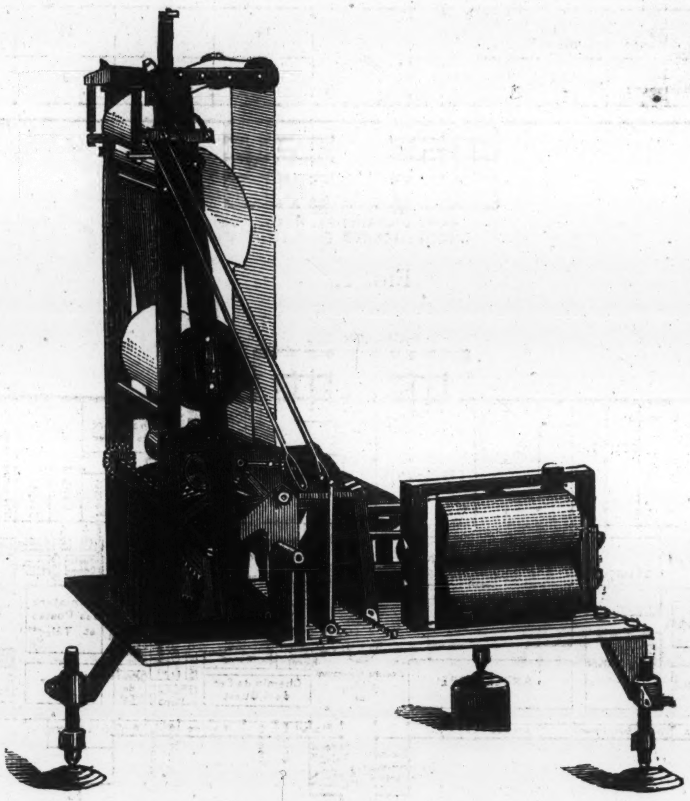


FIG. 1.

brass wheels with engraved figures are likewise combined, by means of electric currents, in such a manner with the above-named metal knobs on the weather-cock and the anemometer that the figure which is uppermost on the periphery of the wheels, at the moment it is about to be registered, indicates the direction of the wind at the same moment, and its mean force during the preceding quarter of an hour. The wheels containing the figures are governed by an electro-magnetic motor, which for each observation sets the five systems successively in motion, until the corresponding wires have reached the mercury in the barometer and the two thermometers, and caused a contact between the above-named metal knob in the weather-cock and the anemometer, and the wheels which are in a mechanical combination with each of these instruments. The numbers, therefore, that are uppermost on the numbered wheels are just those which indicate the height of the barometer and of the two

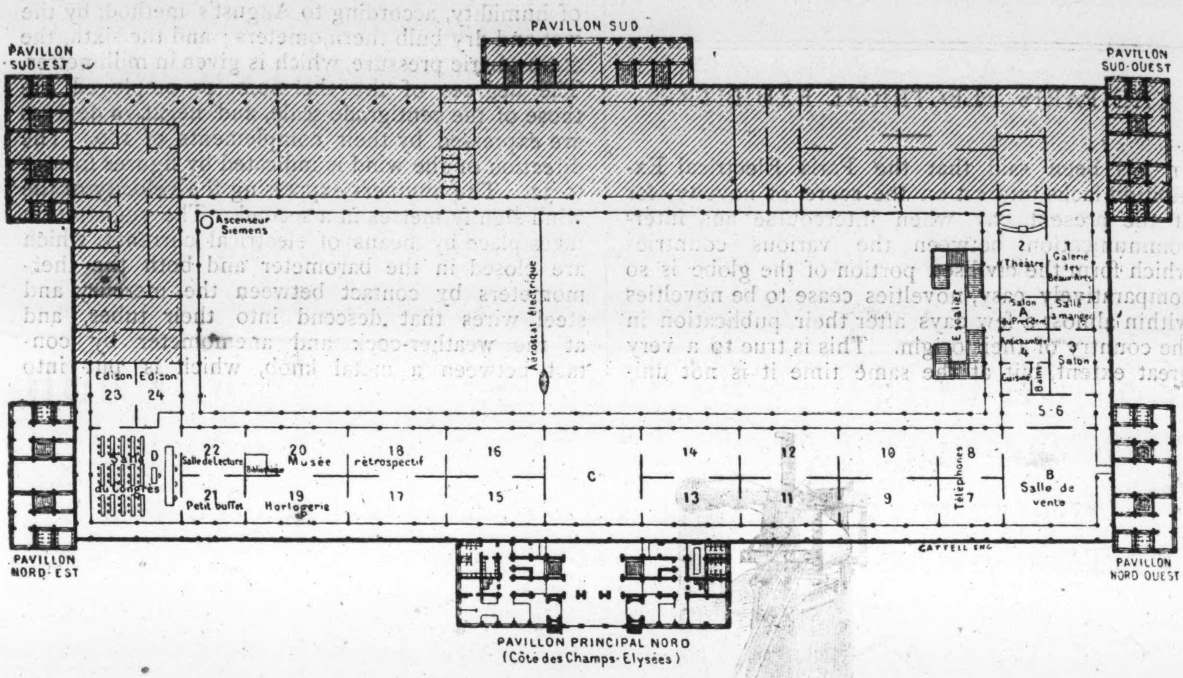


FIG. 2.

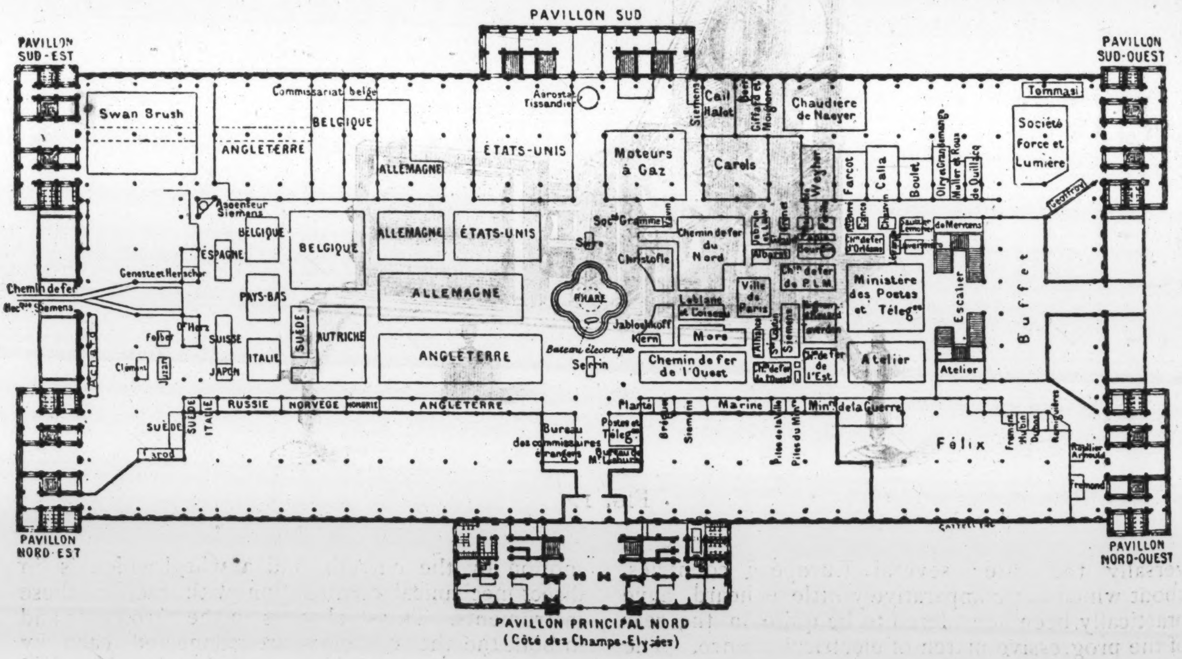


FIG. 3.

thermometers, as well as the direction and velocity of the wind. And, now, the same electro-magnetic motor operates upon a printing apparatus, which, after having deposited colour on the types, presses the above-mentioned slip of paper against them. This being done, the steel wires are drawn up again by the motor, which stops as soon as a certain distance from the mercury is attained, and all is ready for the next observation. The interval between the observations is a quarter of an hour.

The instrument, it will be understood, has the great advantage that it gives the observations in such a form that they may be immediately, and without further modification, used by the meteorologist in his work. A large number of comparisons, very carefully made, have shown that the observations registered with the aid of the method here employed have an accuracy equal to that usually attainable by ocular observation. The zinc vessel, in which the upper ends of the thermometers are inclosed, is so air-tight that it has been found possible, by means of chloride of lime and caustic potash, to keep the inclosed air always free from damp and carbonic acid, a precaution which, it will be easily understood, is necessary in every climate where the temperature is liable to sink below the freezing point, but is still more so in order to protect both the quicksilver and the steel wires from oxydation, and thus preserve the galvanic contact. A meteorograph of this construction has now been used at Upsala Observatory for two years, and during that time it has made four observations every hour without causing any perceptible change in the surface, either of the mercury or the steel wires, that could in any way affect either the free efficiency of the instrument or its degree of accuracy, which, throughout the whole time, has been found to be as above stated. As the clock, which determines the time of the observations, does not require winding up—the instrument itself restoring the tension of the mainspring every quarter of an hour—it continues going as long as the impellent force, *i.e.*, the electric current, is maintained; and as the slip of paper applied lasts for fully three months, it is clear that that is the period for which the instrument may be left to itself. The work then requisite is little more than taking out, cutting, and sewing up, in order, the paper of observations, and replacing it by another slip. Thus it will be seen that this instrument requires but very little time and labour from the person who takes charge of it. The general form of the receiver of the apparatus is shown by fig. 1.

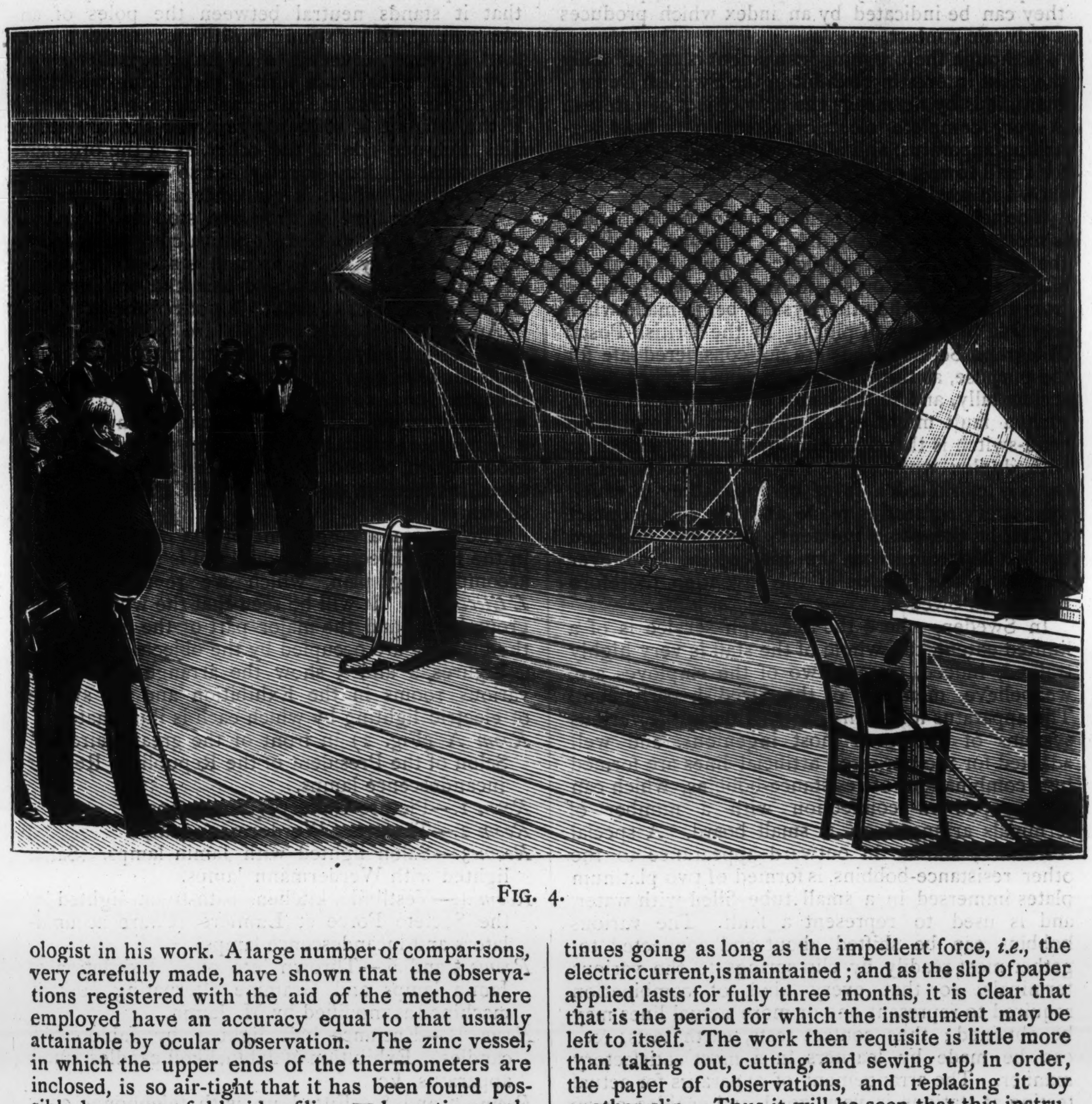


FIG. 4.

A printing meteorograph, differing from this only brass wheels with engraved figures are likewise combined, by means of electric currents, in such a manner with the above-named metal knobs on the weather-cock and the anemometer that the figure which is uppermost on the periphery of the wheels, at the moment it is about to be registered, indicates the direction of the wind at the same moment, and its mean force during the preceding quarter of an hour. The wheels containing the figures are governed by an electro-magnetic motor, which for each observation sets the five systems successively in motion, until the corresponding wires have reached the mercury in the barometer and the two thermometers, and caused a contact between the above-named metal knob in the weather-cock and the anemometer, and the wheels which are in a mechanical combination with each of these instruments. The numbers, therefore, that are uppermost on the numbered wheels are just those which indicate the height of the barometer and of the two

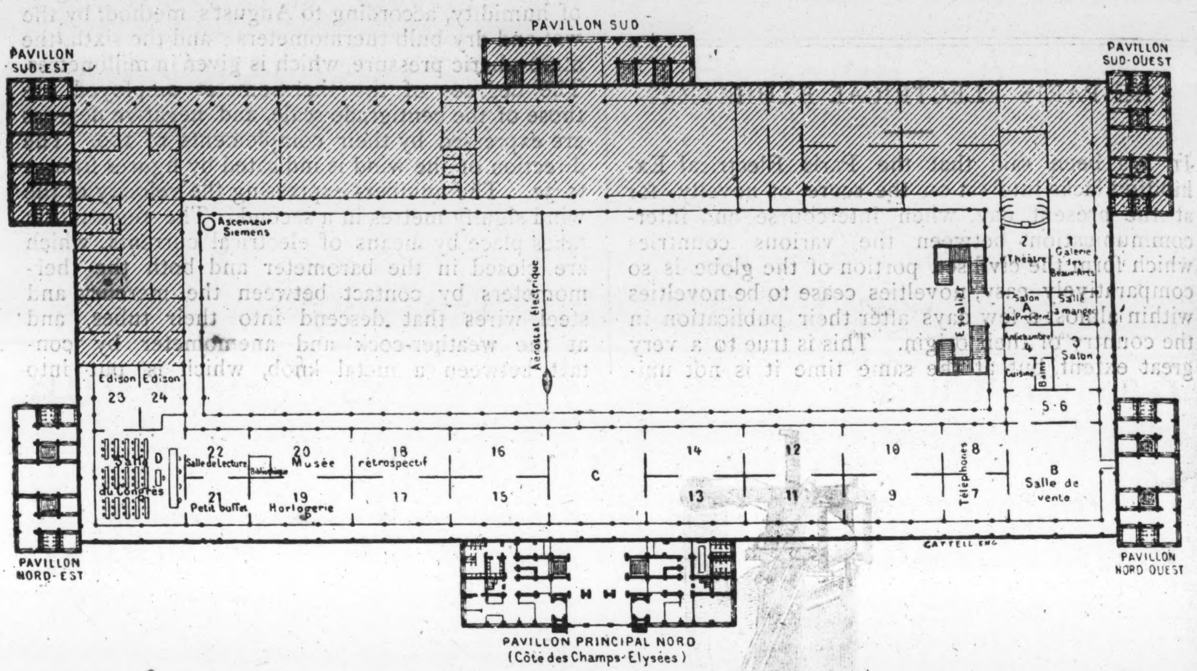


FIG. 2.

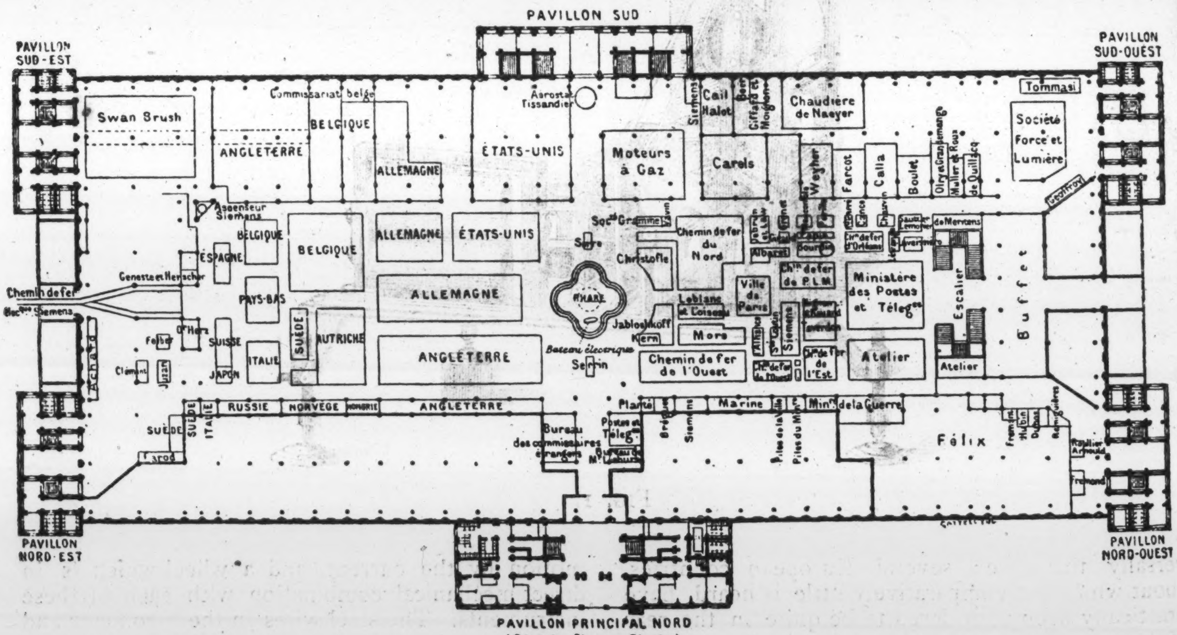


FIG. 3.

thermometers, as well as the direction and velocity of the wind. And, now, the same electro-magnetic motor operates upon a printing apparatus, which, after having deposited colour on the types, presses the above-mentioned slip of paper against them. This being done, the steel wires are drawn up again by the motor, which stops as soon as a certain distance from the mercury is attained, and all is ready for the next observation. The interval between the observations is a quarter of an hour.

The instrument, it will be understood, has the great advantage that it gives the observations in such a form that they may be immediately, and without further modification, used by the meteorologist in his work. A large number of comparisons, very carefully made, have shown that the observations registered with the aid of the method here employed have an accuracy equal to that usually attainable by ocular observation. The zinc vessel, in which the upper ends of the thermometers are inclosed, is so air-tight that it has been found possible, by means of chloride of lime and caustic potash, to keep the inclosed air always free from damp and carbonic acid, a precaution which, it will be easily understood, is necessary in every climate where the temperature is liable to sink below the freezing point, but is still more so in order to protect both the quicksilver and the steel wires from oxydation, and thus preserve the galvanic contact. A meteorograph of this construction has now been used at Upsala Observatory for two years, and during that time it has made four observations every hour without causing any perceptible change in the surface, either of the mercury or the steel wires, that could in any way affect either the free efficiency of the instrument or its degree of accuracy, which, throughout the whole time, has been found to be as above stated. As the clock, which determines the time of the observations, does not require winding up—the instrument itself restoring the tension of the mainspring every quarter of an hour—it continues going as long as the impellent force, *i.e.*, the electric current, is maintained; and as the slip of paper applied lasts for fully three months, it is clear that that is the period for which the instrument may be left to itself. The work then requisite is little more than taking out, cutting, and sewing up, in order, the paper of observations, and replacing it by another slip. Thus it will be seen that this instrument requires but very little time and labour from the person who takes charge of it. The general form of the receiver of the apparatus is shown by fig. 1.

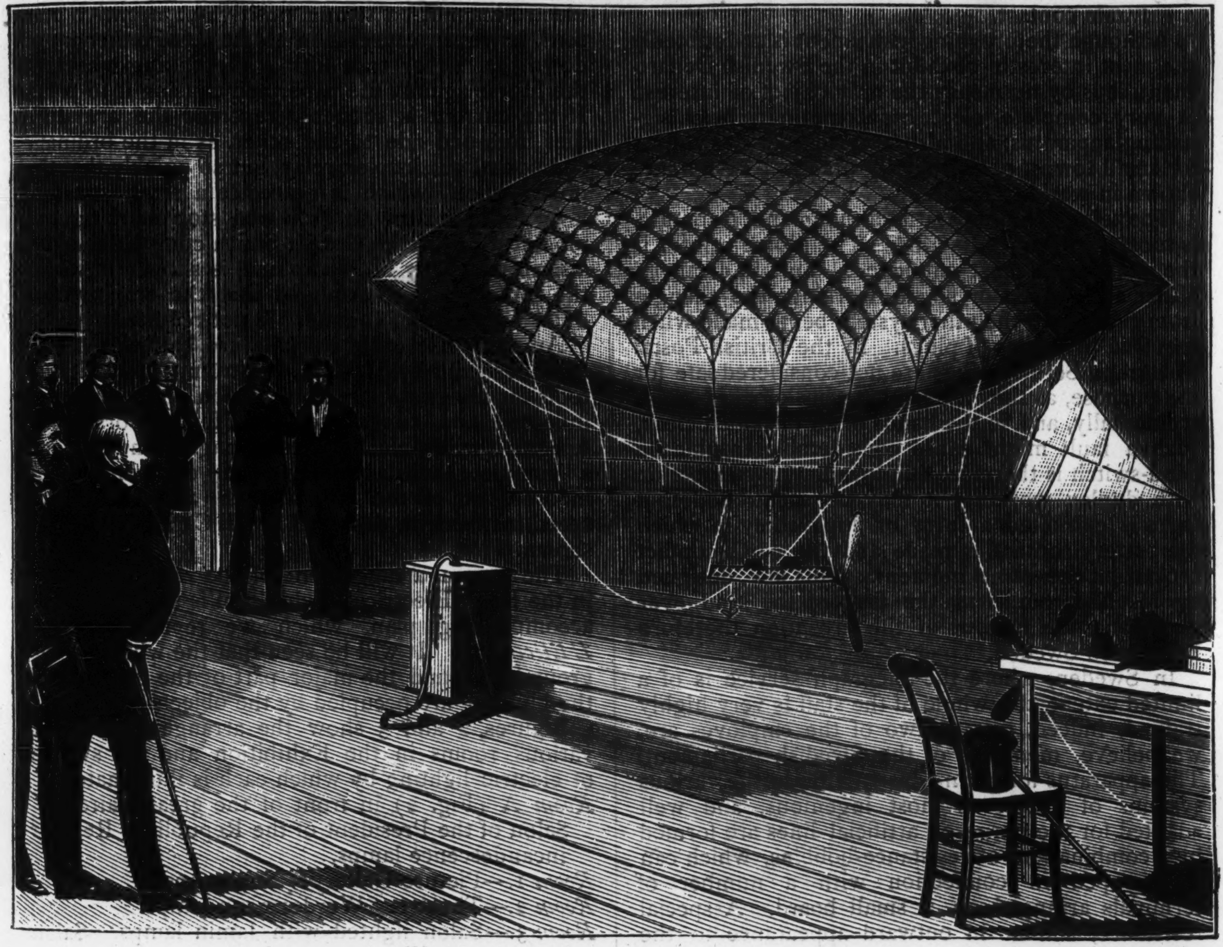


FIG. 4.

A printing meteorograph, differing from this only so far that the latter has been improved and perfected in several details, has been constructed by the same mechanician, Mr. Sörensen, for the Imperial Central Establishment for Meteorology in Vienna, where it has been in daily use since September, 1874; and during that time it has given exact and true observations. A description of this meteorograph is inserted in "Zeitschrift der Osterreichischen Gesellschaft für Meteorologie, redigirt von C. Jelinek und J. Hann," Volume X., Nos. 16 and 17.

Finally, it is pointed out that the principle on which this instrument has been constructed may be adopted, with the same advantage, for observing the particulars of any other phenomenon, provided they can be indicated by an index which produces a galvanic contact.

Although the foregoing instrument is undoubtedly the most interesting exhibit in the Swedish Department, it is by no means the only object of interest. A very complete electric automatic railway signalling apparatus, and also a system of fire-alarms for small towns, of thoroughly practical design, are shown in working order.

The telegraphic apparatus, although not elaborate, is most excellent of its kind. The Morse printer is the instrument most employed. This is arranged either for duplex or single working, the changes from the one to the other system being made when required by means of plugs. In the British Postal Telegraph Service plugs are not considered safe for the purpose, as they are liable to be knocked loose accidentally, and, in the hands of an unskilled clerk, such a fault might cause considerable trouble; a hand-switch is therefore employed. In connection with duplex working, it may be mentioned that there is exhibited a form of duplex key in which the battery contact is made and the earth contact broken at the same moment. This key, designed by M. Nyström, was the first of the kind ever made, and the honour of the invention therefore belongs to Sweden.

In Sweden, where the telegraph service is of a limited extent, the whole of the staff is very highly trained, indeed, one or two of the employés are, we believe, members of the Swedish parliament. The apparatus for giving instruction in the various systems of testing is most ingenious, and well adapted for the purpose; artificial lines are formed by a combination of resistance-bobbins, which can be grouped in connection with a number of terminals arranged on a small board. A special resistance, similar in outward appearance to the other resistance-bobbins, is formed of two platinum plates immersed in a small tube filled with water, and is used to represent a fault. The various bobbins can be shifted about and connected together most readily by clip springs to the various terminals, so that every kind of combination required to represent one or more actual lines may be obtained; thus contact tests, earth tests, &c., can be made by learners in a most satisfactory manner. The arrangement of apparatus for actual testing at stations is very good, and enables every variety of test required to be made with the least trouble possible. In countries like Sweden, where lengths of line stretch for perhaps two or three hundred miles without an intermediate station, accurate tests for localising faults are highly necessary, and the arrangements referred to are certainly thoroughly well designed for the purpose.

Amongst the historical exhibits we observe a differential galvanometer designed by M. Edlund; to the latter gentleman belongs the credit of having been the inventor of the differential principle.

A most ingenious mechanical arrangement for the quadruplex telegraph system, devised by M. Wennman, preliminary director of the Telegraph School, Stockholm, is also shown. This arrangement enables the use of relays on short lines worked on the quadruplex system to be dispensed with. One of the Morse printers, which is caused to respond to strong currents, is provided with a polarised armature, which is normally set so that it stands neutral between the poles of an electro-magnet; a strong positive or negative current, however, causes it to be attracted either up or down, in either case lifting the inking-wheel of the Morse against the paper and causing it to print. If the current is suddenly reversed the armature flies from one side to the other, as in the ordinary compound quadruplex relay, but so quickly that the inking-wheel, which is geared to a small separate lever, has not time to drop and stop marking. A modification of the Gerritt-Smith compound relay, also invented by M. Wennman, is shown, in which the contacts are so arranged that the employment of an "uprighting sounder" is not required.

Amongst the other exhibits are batteries of the form designed by M. C. A. Nyström, a collection of tools for telegraph line construction; pole climbers, invented and constructed by M. G. Forssberg; telegraph wires, electrometers, magnetometers, and a complete military telegraph equipment. A modification of the Wheatstone automatic fast-speed instrument, designed by M. Carlander, is also shown.

The general arrangement of the various sections in the Paris Electrical Exhibition is shown by the accompanying plan, which we reproduce from *L'Eléctricien*. It will be seen that the whole of the ground-floor and the major part of the galleries of the building are occupied by the objects exhibited.

Figures 2 and 3 show the arrangement of the various rooms in the Exhibition and the system of electric lighting by which each is illuminated.

Room A (Fig. 2) in front of the great staircase. Salon of the President of the Republic. Reynier incandescence lamps.

Room 1.—Picture Gallery. Sun lamps.

Room 2.—Theatre. Werdermann lamps.

Room 3.—Salon lighted with Jamin lamps. Salon lighted with Werdermann lamps.

Room 4.—Vestibule, kitchen, bath-room, lighted by the Société Force et Lumière (Faure accumulators and incandescence lamps).

Rooms 5 and 6.—Thrown into one. Exhibition of Jamin lamps and Gramme alternating current machines as modified by M. Jamin.

Room B.—Entrance hall lighted by Jablochkoff candles. Exhibition of Jablochkoff candles, small apparatus, &c.

Rooms 7 and 8.—Fitted up with telephones connected to the auditorium of the Opera House. *Room* 7 lighted by the Société Force et Lumière. *Room* 8 lighted by the Brush Company.

Room 9.—Medical and telephonic apparatus, coils, &c. Lighted by the De Méritens system.

Room 10.—Exhibition of the Sautter and Lemonnier light. Apparatus for domestic purposes.

Room 11.—Jablochkoff light. Liébert's photographic studio.

Room 12.—Spanish Electric Light Company (Gramme lamps). Carbons and electric lamps.

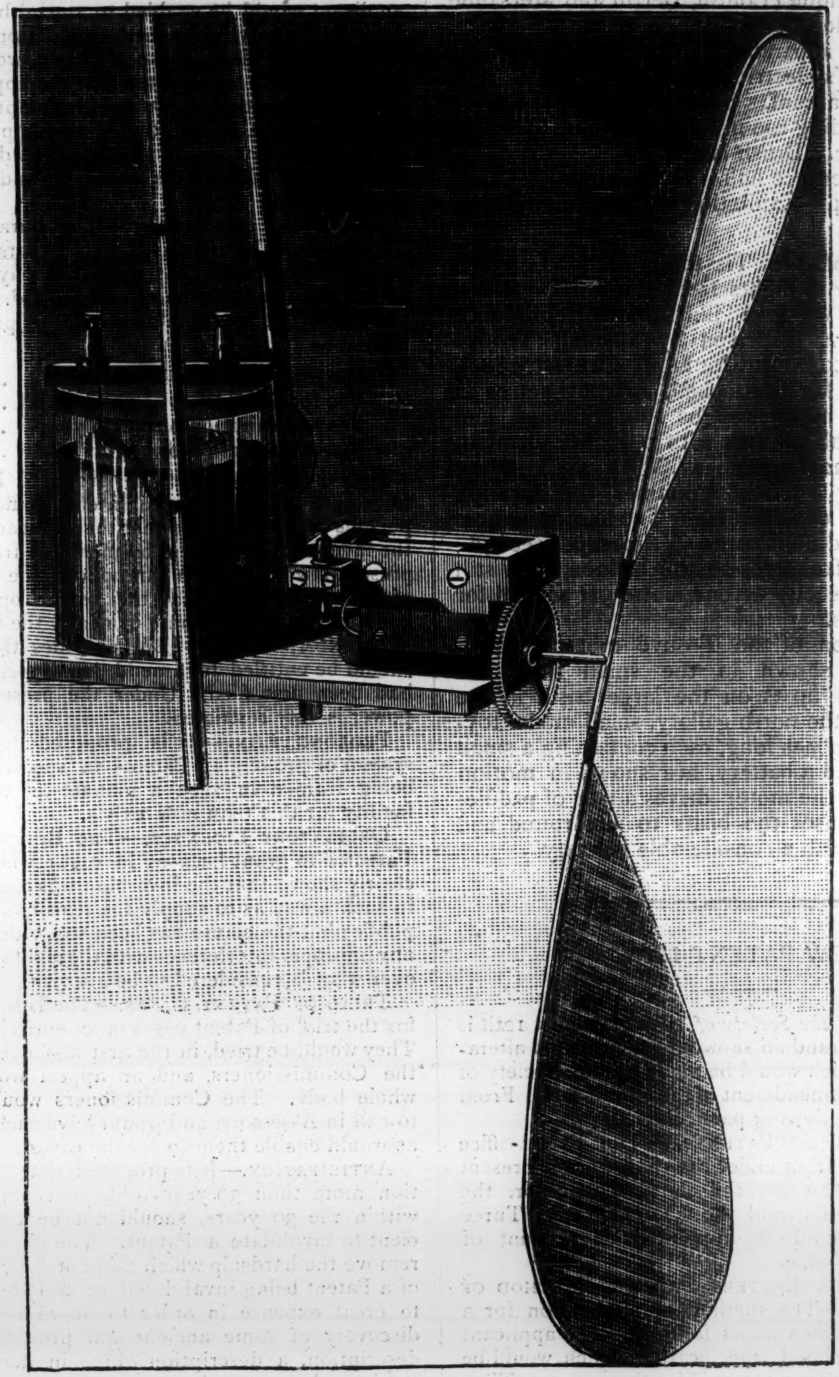


FIG. 5.

Room 13.—Siemens' electric light (differential lamps). Apparatus for electric measurement. Coils, electro-magnets, Geissler tubes, &c.

Room 14.—Paris Electric Light Company (Wilde and Alliance machines, Wilde candles). Telegraphic and domestic apparatus. Bells.

Room C.—United States Electric Light Company (Maxim system). Cables, telephones, and telegraphic apparatus.

Room 15.—Jaspar electric light system. Electric lamps, telegraphic apparatus, batteries, bells, lightning conductors.

Room 16.—Anatole Gérard's electric lamps. Apparatus of various kinds, wire, &c.

Room 17.—Syndicat de l'Electricité. Gramme lamps, electro-chemistry apparatus, batteries, electrotyping, &c.
Room 18.—Old apparatus. Mignon and Rouart's electric light.
Room 19.—Exhibition and lighting by the Société lyonnaise de constructions mécaniques et de lumière électrique (Lontin, Bertin and Mersanne systems). Electric clocks.
Room 20.—Old apparatus; Fyfe's electric lighting system; Daft's electric lighting.
Room 21.—Restaurant. Swan electric lighting.
Room 22.—Reading room. Journals and books on electricity, &c. Brush lamps.
Room D.—Conference hall. Swan lamps.
Rooms 23 and 24.—Exhibition and electric lighting, by Edison.

The model of the Tissandier balloon, which makes short aerial flights from the north gallery, and of which we give illustrations reproduced from *La Nature*, is driven by a small Trouvé motor (see TELEGRAPHIC JOURNAL, Oct. 1st, 1880), to which a large fan is attached, 40 centimetres in diameter. The motor weighs 220 grammes, and works for several minutes with a Planté element, also weighing 220 grammes. With a secondary couple weighing 1·300 kilogrammes, the duration of the motion is considerable. The motor bobbin under these conditions turns 6½ times per second; by turning, the fan gives to the balloon, in a still atmosphere, a velocity of one metre per second for about 40 minutes.

The application of the Trouvé motor to propulsion is also shown in the small skiff, *The Telephone*, which floats on the large basin in the central hall. In the north gallery, small model toy-boats, about 18 inches long, each containing a small Trouvé motor and a battery, are shown in motion in a small tank; the motor drives a pair of paddle-wheels, which causes the boats to run round and round the tank with a considerable velocity.

NEW PATENT LAW.

IN the *Journal of the Society of Arts* of August 12th is published a memorandum showing the principal alteration in the law which would be made by the Society of Arts' Bill for the Amendment of the Patent Law. From it we extract the following particulars:—

COMMISSIONERS OF PATENTS.—The Patent-office would be removed from under the charge of the present Commissioners, who are the Lord Chancellor, the Master of the Rolls, and the Law Officers. Three Commissioners would be appointed on account of their special knowledge.

APPLICATION FOR LETTERS PATENT.—METHOD OF GRANTING SAME.—The method of application for a Patent would be somewhat as follows:—The applicant would file a Provisional Specification, which would be referred to Examiners appointed for the purpose. They would see that the invention was proper subject-matter for a Patent; that the Specification fairly described the invention; and that it was generally intelligible and properly drawn. They would not inquire into novelty or utility. They would report, and their report would be shown to the applicant before being seen by the Commissioners. The applicant would then have an opportunity of conferring with the Examiners as to any required alterations. Provisional Protection would be granted immediately on receipt of the application, and would last for nine months. Before the end of that time the applicant would be required to file a Complete Specification, fully describing his invention. This would be referred to the Examiners, and treated in the same manner as the Provisional Specification. The applicant would be enabled to amend his Specification in accordance with the recommendation of the Examiners, and, on his doing so, a Patent would be granted. If the Examiners reported that the application was in respect of matters which could not properly be made the subject of a Patent, and if the applicant still persisted, a Patent would still be granted, but the objections of the Examiners would be endorsed upon the Specification.

DURATION OF PATENT.—The duration of Letters Patent would be increased to 17 years—the duration being as now contingent upon the payment of fees at or before the expiration of each period.

FEES.—The fees would be half the present amounts, namely—

Fee for Provisional Protection . . .	£2	10
Fee for Grant	10	0
Fee at expiration of fourth year . .	30	0
Fee at expiration of eighth year . .	60	0

OPPOSITION.—Under the proposed Bill, opposition to the granting of Letters Patent would be limited to persons who could state that the applicant had obtained the invention from them by means of fraud. Under the present law any person can oppose, the general ground of opposition being that the person opposing already has a Patent for the same or nearly the same invention.

AMENDMENT.—The Bill provides that the inventor should be entitled to amend his Specification after it had been first filed. Under the present system this power is very restricted.

PROLONGATION.—It is proposed to continue the system of prolonging Patents in special cases, the Bill being framed in such a manner as to give greater facility for this than now exists.

OBLIGATORY LICENSES.—The Bill would compel a Patentee to grant licenses in cases where it could be clearly shown that the invention was not being worked in such a way as to supply the reasonable wants of the public; but the clause has been so worded as to prevent any improper interference with the rights of the Patentee over what is considered to be his own private property.

TRIAL OF PATENT CASES.—The Bill would provide for the trial of Patent cases in an entirely new manner. They would be tried, in the first instance, before one of the Commissioners, and an appeal would lie to the whole body. The Commissioners would have power to call in Assessors, and would have such other powers as would enable them to try the cases fully.

ANTICIPATION.—It is proposed that a mere publication more than 30 years old, unaccompanied by use within the 30 years, should not be considered sufficient to invalidate a Patent. The object of this is to remove the hardship which now not infrequently occurs of a Patent being invalidated, or a Patentee being put to great expense in order to prove his claim, by the discovery of some ancient and probably incomplete description, a description which in many cases could not have been put into operation at the time it was made, for want of necessary appliances to carry it into effect.

PATENTS TO FOREIGNERS.—It is proposed that Patents should be granted to foreigners or persons resident abroad on precisely the same terms as those on which they are granted to British subjects resident in the United Kingdom.

EFFECT OF FOREIGN PATENTS ON ENGLISH PATENTS.—At present an English Patent lapses at the expiration of any Foreign Patent taken out by the same inventor for the same invention. It is proposed in the Bill that English Patents should not in any way be affected by Foreign Patents.

CITY AND GUILDS OF LONDON INSTITUTE.

THIS institution for the advancement of technical education, strong and vigorous, although still quite in its youth, has recently issued a report of the third examination, held on the evenings of the 25th and 26th May last. Under the head of telegraphy we find that 99 candidates presented themselves, and out of that number 49 passed, whilst 50 failed. Electro-metallurgy produced but four candidates (against six last year); two passed and two failed. In the extracts from the reports of the examiners we note the following remarks by Mr. W. H. Preece, F.R.S., examiner in the subject of telegraphy:—"I have upon a previous occasion remarked upon the absence of any drawings to illustrate answers. It is surprising what small use is made thus of the pen and pencil. A simple sketch would often obtain more marks than a whole page of writing. One request in the questions was to describe a telephone; and, although this instrument has been before the world for four years, and has been talked of more or less all over the world, nothing is more astonishing than to note the few correct answers which have been given."

"There seems to me to be in many places an absence of apparatus for examination. It is very easily found by the character of the answers when the examinee is a telegraph clerk, with the use of telegraph apparatus at his office."

The sub-committee, having had under their consideration the results of the recent examinations in technology, and also various suggestions from the examiners and teachers of the institute, as well as the report of the director's visit of inspection to several technical classes in the north of England in connection with the institute, have resolved to recommend to the executive committee the adoption, for 1882, of a revised set of regulations.

These regulations differ from those contained in the programme for 1881 in several important particulars; those referring to subjects more immediately connected with electrical science run as follows:—

"The great and increasing importance of industries connected with the various applications of electrical science has induced your sub-committee to suggest the introduction into the programme of an examination in Electric Lighting and the Transmission of Electrical Energy, and also in another industry, to which special attention has been given in the Cowper Street Classes, viz., Electrical Instrument Making. These subjects, together with Telegraphy, it is suggested, should be grouped under one heading, viz., "Electrical Engineering."

The programme for the City Technical Science Classes, Session 1881-1882, has also been issued.

During the winter term, commencing October 3rd, 1881, Professor Armstrong, Ph.D., F.R.S., and Professor Ayrton, F.R.S., will continue their tutorial and laboratory courses of instruction in chemistry and physics at the Cowper Street Schools, Finsbury, in rooms rented from the Middle Class School Corporation, pending the completion of the City and Guilds of London Technical College, Finsbury.

From this time the Trade Classes transferred from the Artisans' Institute, St. Martin's Lane, W.C., will also be conducted in the same building.

The Physical Laboratory will be open daily (Saturdays excepted) from 10 to 5 p.m., and on Monday and Wednesday evenings from 6.30 to 9.30 for students desiring individual practical instruction in Technical Physics. The fees are inclusive of apparatus and materials.

There will also be the following classes and lectures:—Professor Ayrton will continue on Monday evenings, from 8.30 to 9.30, commencing October 3rd, the course on Electrical Instrument Making, and give practical instruction in the scientific principles underlying the manufacture and testing of condensers, induction coils and telephones. The students will have the opportunity of performing themselves the experiments suggested at the lectures, as well as of obtaining information from the professor regarding technical difficulties, by attending a special laboratory course, to be held on Monday evenings, from 6.30 to 8.30, commencing October 3rd.

The syllabus of the course on Electrical Instrument Making includes such subjects of study as condensers, submarine duplex telegraphy, induction coils, and telephones.

On Wednesday evenings, from 8.30 to 9.30, from October 5th, Professor Ayrton will continue the course on the Electric Light, especial attention being devoted to the construction of the various forms of generators, and to the laws governing their action and efficiency. The practical application of the principles of the electric transmission of power to electric railways will be entered into, and a critical examination made of the various systems of electric lighting at present employed in London.

A special laboratory class for students attending this course will be held on Wednesday evenings, from 6.30 to 8.30, in which students will be taught to make exact measurements of electric currents, electro-motive forces and resistances, and to practically use absolute instruments when very strong electric currents have to be measured. They will then practise making measurements of the illuminating power of electric lights produced by various strengths of electric current, generated by dynamo-electric machines driven by a six horse-power gas engine in the laboratory fitted with suitable gearing to enable the dynamo-machines to be run at any desired speed; and they will compare the relative illuminating powers with the energy absorbed in the arc in each case, so as to determine experimentally the relative efficiencies of different forms of electric lighting. The students will also experiment on the sensibility of the various lamps as regards their automatic adjustment, and on the efficiency of dynamo-electric machines relatively to one another, and to batteries for the production of the electric current. Experiments will likewise be made regarding the practical efficiency of electric transmission of power under various conditions.

The syllabus of the course on the electric light and transmission of power includes such subjects as the "General Principles of Electric Transmission of Power," "Generators of Electric Currents," "Electric Railways," "Present Electric Lighting of London."

On Friday evenings, from 7 to 8.30, commencing October 7th, a course of lectures will be given on the classified series of electrical experiments which have been arranged in the laboratory to enable students to verify the fundamental principles and laws in electricity and magnetism.

The syllabus of the course on electrical laboratory apparatus contains also the following subjects in their various branches: "Electrification," "Conduction," "Insulation."

There will likewise be a preliminary course of lectures on Electricity and Magnetism, fully illustrated with experiments, which will be delivered on Tuesday and Thursday afternoons, from 1.45 to 2.45, commencing October 4th. This preliminary course, although a continuation of the one commenced at the beginning of this year, will be so arranged that it may be joined by new students desirous of obtaining such preliminary training as should be possessed by students proposing to study any branch of electrical engineering.

A laboratory class adapted to the students attending this course of lectures will be held on Thursdays, from 10 a.m. to 1 p.m.

Students attending regularly any of the chemical or physical courses during the entire session, and passing a satisfactory examination, will receive a qualifying certificate, entitling them to the full technological certificate of the institute on passing the technological examinations in allied subjects.

Altogether, it may truly be said that the instruction proposed by the various professors is of a most interesting and thorough nature. We doubt not that a great increase in the number of students will prove that the young men of the present day are ready to benefit by the instruction which scientists and their supporters are so energetic and liberal in placing within their reach.

THE CONGRESS OF ELECTRICIANS AT THE PARIS ELECTRICAL EXHIBITION.

THE Congress, which is to be held at the Paris Electrical Exhibition, will be divided into three sections; the first will consist of physicists, chemists, physiologists, and persons who study electricity from a theoretical point of view. The second section will include telegraphic and railway engineers. The third section will be formed of electricians and engineers, and others who are employed in both the civil and military applications of electricity.

The meetings of each section will be held at different times, so that the members of any one section may be able to contribute papers to any other section. The Séances which will be held will be threefold:—1st. "Séances Plénières," in which International matters requiring a vote from the Congress will be discussed. 2nd. "Séances des Sections," in which matters of special interest will be considered in which an exchange of ideas can be given. 3rd. "Séances Publiques," in the form of conferences, in which any subjects which may be suggested will be discussed.

In the "Séances Plénières" the general questions for discussion will be—

1st.—Electrical Units.—The adoption of an international system. The points to be considered under this head will be—

1. Necessity for the adoption of a uniform system.
2. Choice of a system and names to be given to the units.
3. Measures to take for the establishment, the preservation, and reproduction of the units.
4. Should an international commission be established?
5. Should the electrical standards be under the same department as the weights and measures.

2nd.—International Telegraphy.—Measures to be taken to facilitate the working of international telegraph lines. The points to be considered under this head will be—

1. The means to assure the employment of the same electrical terms and units.
2. The possibility of the systematic study of earth currents.
3. Regulation of the establishment of submarine cables as regards their juxtaposition and crossing.
4. Signals, &c., to distinguish cable ships.

3rd.—Various Applications of Electricity.—Measures to take to facilitate scientific international relations as regards that which concerns certain special applications of electricity. The points to be considered under this head will be—

1. The electric light. The facilitation of the comparison of luminous intensities.
2. Electrophysiology. The effects obtained in the employment of electro-chemical apparatus.
3. Lightning conductors. Collection of statistics with reference to the comparison of the relative efficiency of conductors at present in use.

In the "Séances des Sections" the general questions for discussion will be—

1st Section.—Theory; Sources of Electricity; Lightning Conductors; Electrophysiology. The points to be discussed under this head will be—

1. The theory of electricity.
2. The measurement of currents of great intensity, whether alternate or continuous.
3. The physique of the globe. Atmospheric electricity and terrestrial magnetism.
4. Lightning-rods. The best conditions for the establishment of lightning-rods, and the possibility of statistical compilations as to their efficacy.
5. Electrophysiology, and the necessity of a system of measurement in units in connection with the same. The best means to determine the nature of electric phenomena produced in animals.
6. Miscellaneous questions initiated by members.

2nd Section.—Transmission of signals and speech by electricity; telegraphy, telephony, and railways. The points to be discussed will be—

1. The relative efficiency of dynamo machines and batteries for telegraphic purposes. Best conditions for establishing open or underground lines as regards their conductivity and insulation. Advantages and disadvantages of relays on long lines. Lightning-protectors for instruments. Advantages and disadvantages of wire protectors.
2. Telephony. Difficulties in establishing telephonic communication. Telephonic disturbances.
3. Railways. Application of electricity to railway purposes. Comparison of the relative efficiency of automatic and hand-worked signals.
4. Questions initiated by members of the Congress.

3rd Section.—Industrial applications of electricity. The points to be discussed will be—

1. Electric lighting. The adoption of a unit of luminous intensity. Possibility of the establishment of simple rules for photometric measurements. Comparison of the relative efficiency of direct and alternate current machines. Special conditions as regards the application of the electric light to towns, worshops, mines, ships, &c.
2. The transmission of power. Known facts in connection therewith, and results obtained. Difficulties in connection with. Utilisation of natural forces.
3. Industrial distribution of electricity.

4. Clocks, chronographs. Applications to geodesy.
5. Electro-metallurgy. Applications of electricity to chemistry.
6. Questions initiated by members of the congress.

"Séances Publiques." The suggested programme is as follows—

1. Electric measurements.
2. Electric light.
3. Transmission of power.
4. Telephony.
5. Atmospheric electricity and lightning-conductors.
6. Terrestrial magnetism.

ERRATA.

Aug. 15*th*, page 314, *Molecular Torsion and Molecular Magnetism*, by G. Gore. First col. page 314, third line from bottom, read "2·75 metres" for "2·75 mm.;" second col. page 314, second and third lines from top, read "a current flowing" for "a current following."

Correspondence.

ELECTRIC LIGHT.

To the Editor of The Telegraphic Journal.

Sir,—From time to time, as you are aware, in addressing your Journal on the topic of the various systems of electric light, I have dwelt upon the fact that "simplicity" in the arrangements of the lamp is absolutely necessary for efficient working. Many of the regulating systems, when workable, produce no doubt a grand light, but the difficulty seems to be to render them workable. "Regulators," as before said in a former letter, require "lamp-lighters to regulate the regulators;" this was prominently noticeable at Covent Garden the other evening. I observed the Brush lights burning but badly, particularly in the Floral Hall, where they had seven lamps. During two hours' close watching, the whole seven lamps in this hall were never at one time in workable order; one was all but out, and as it temporarily recovered itself, another followed suit, and so they went on, playing bopeep, until, during the interval, when the hall was crowded to suffocation, the entire system broke down, leaving the hall in total darkness, save a few gas jets, burning over the buffet. *If* pickpockets were among the crowd, and chose to ply their avocations, they certainly had an opportunity. The cause of the extinction was no doubt the failure of the regulators to regulate the lamps; there was no want of attendance, as the electric lamp-lighters were cutting about in all directions. Before concluding, a word upon incandescent lights, and the supposed candle-power of regulators: as regards the former, they are more or less of the same calibre, ten to twelve candle-power, and new ones seem to shine forth monthly. For the small cabins of ocean steamers they are perhaps suited, but I am afraid they will be found an expensive light (if they *really* possess true illuminating power at all); for instance, a 20 horsepower engine which drives sixty lights on the Thames Embankment of over 200 candle-power each, would hardly, I believe, suffice to drive 40 incandescent lamps of, as above said, 12 candle-power; there is thus an enormous difference in the power required. Touching the latter, viz., the candle-power of the various regulators, I think it is high time that the owners of such should be compelled to have them measured photometrically, and not be allowed to give forth to the public that a lamp is of 1 to 6,000 candles. I see in one of this morning's papers an account given of the Compton, in which one of their lamps is called 6,000 power? Were this lamp tested by the Board of Works, the probability is, it would have to sing very small; and it is unfair that the public should be deceived by circulars or advertisements, stating the light power based merely on a supposed or imaginary standard. One large regulator company, who described their lights as 1,000 candle-power, I know, have been tested by the photometer and found to be little over one-half.

Yours obediently,

ELECTRON.

Junior Carlton Club.
August 12th, 1881.

Notes.

On an Alteration of the Electric Lamp.—By Mr. Jamin.—As soon as he had discovered the electric arc Davy placed it in a vacuum, and observed that its length was increased and that the carbons were not consumed. Since that time many persons have endeavoured to inclose their apparatus in confined air, but never, to my knowledge in vessels hermetically closed, nor in gases which have no action on carbon at a red heat. This depended, doubtless, on the difficulties of the experiment, because of the size of the regulators. The lamp which I have described to the Academy, admitting of being reduced to a very small bulk, may be fixed either in a vacuum or in inert gases, in globes entirely closed.

Among the gases which are without action on the carbons may be mentioned acetylene, carbonic oxide, marsh-gas, and probably sulphide of carbon; most of the others are decomposed. Thus the vapour of water gives carbonic oxide as acetylene, carbonic acid doubles its volume and is converted into carbonic oxide, the carbides of hydrogen, and especially the vapour of petroleum, are decarbonised and give rise to filaments of coke, which connect the carbon points and convert the arc-apparatus into an incandescent burner.

Air offers an especial interest. We see the globe at first filled with reddish vapours, from the combination of the oxygen and nitrogen under the electric influence. This compound is soon decomposed, and the gas becomes colourless again. It is evident that the hypo-nitric acid, after having been formed under the electric influence, is decomposed in turn so as to supply oxygen to the carbon. Finally there remain mere carbonic oxide and nitrogen.

During this time the electric arc undergoes corresponding modifications. As long as there are reddish vapours it varies both in intensity and colour, but as it is decolorised the flame becomes stable and changes its hue. When all the chemical changes are completed, it is reduced to a well-defined arc, of a greenish blue, unmixed with other colours. It becomes absolutely stable without any fluctuation in its intensity, or variation in its colour or position. I have never, in any case, remarked so complete a stability which, of course, involves the same invariability in the brightness of the points. I believe that this circumstance is of the utmost importance as relieving us from the irregularities met with in all carbons.

The spectrum is furrowed by an incredible quantity of very fine and almost regular rays. We remark in it four great maxima, which arise abruptly from the more refrangible side with a very bright line, which is repeated afterwards at equal intervals, but growing fainter. These maxima are in the yellowish green, the blue and the violet. They only remain visible when the light diminishes. This is the electric spectrum of the vapour of carbon rendered incandescent, but without burning.

It is different in the air: the carbon burns, the arc is red, and the former spectrum and another due to combustion, and which is totally different, follow each other at regular intervals. It presents a splendid collection of bright rays, due to the combustion of the metals contained in the carbon. It is clear that in an inert gas we have a simple phenomenon, purely electric. The arc is a current which we can direct and keep invariable at the points of electro-magnetic actions; hence the light takes so remarkable a stability. In free air, on the contrary, the phenomenon is complex. There is still a current which we may fix, but there is also the combustion of the carbons against which we are powerless. It varies from moment to moment from the want of homogenity of the carbons, which occasions those fluctuations of which the electric light is justly accused.

If we operate in confined air we observe at first the spectrum of combustion. As soon as the chemical changes begin the electric spectrum appears. The two are never seen together; they succeed each other alternately; gradually the duration of the combustion-spectrum decreases, whilst that of the electric spectrum increases, and at last becomes permanent.

It is very noteworthy that in the two cases the arc is characterised by spectra so unlike each other, and that the oscillations of the light are merely a mark of the transition from one spectrum to the other.

What must concern us still more is that the carbons as they cease to burn cease to waste. If we operate in the air with a medium current, we expend about 0·16 metre of "candle" per hour; and as there are five "candles" of 0·32 metre per lamp, this is a duration of ten hours, or one night. In the closed apparatus, in proportion as the gas is transformed, the consumption decreases rapidly and is reduced to about 0·002 metre per hour. Each candle lasts 160 hours, each lamp 800 hours, or 80 nights of 10 hours each.

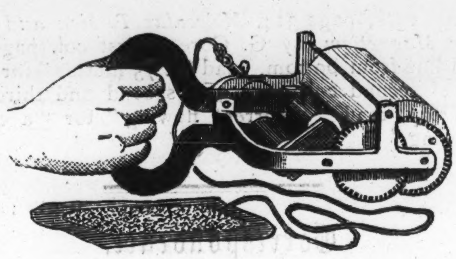
It may be said that the electric light becomes perpetual; that it is sufficient to replace the carbons when it is needful to clean the lamp; that the consumption of carbons is almost at an end; that their quality becomes indifferent; that all daily attention is suppressed, while the light acquires a constancy hitherto unknown. It may be added that in virtue of its former properties the lamp is lighted spontaneously as soon as the circuit is closed.

Practically, the dimensions of the glass globe which contains the burner should be reduced as much as possible; great care should be taken to prevent the entrance of air while the globe cools, though the gas within must be allowed to escape by means of a valve while the lamp is in action.—*Comptes Rendus.*

Dr. Butler's Electro-Massage.—A large portion of electrical treatment that hitherto could only be carried out by specialists, by using elaborate apparatus, by the proper use of a new mode of treatment, by employing the apparatus shown in the engraving, can be intrusted to the hands of those who are not so skilled.

By means of this simple machine the manipulator transfers the mechanical motion used in rubbing the patient into an electrical current, and the current as it is generated is transmitted through the part while being rubbed, and it fulfils the requirements of a treatment including rubbing, kneading, pounding, flexing, &c., combined with the application of the electric current.

The instrument consists of a metallic roller, covered with chamois leather or other suitable material, an electro-magnet, and a permanent magnet set in a strong frame, which holds the instrument together. The roller, besides acting as the driving wheel of the machine, is so arranged that it also acts as one of the electrodes by which the current is transmitted, and is connected by gearing with the electro-magnet so as to cause the poles of the latter to revolve opposite those of the permanent magnet, which forms the handle of the instrument. Each revolution of the roller produces twenty-five revolutions of the electro-magnet, which is magnetised and demagnetised at each revolution, and thus induces a current of electricity which is ample for all purposes for which it is intended. The circuit is completed by connecting any required electrode by the binding post at the side of the instrument, the roller acting as the other electrode; both are brought into contact with the surface of the body of the patient, and as the roller is moved about over the surface, the current is established and transmitted through the part over which the roller is made to revolve.



The machine includes in itself an electric generator, a rubber, a kneader, a manipulator, and a set of electrodes, all in one. Any person of ordinary intelligence can be taught to use it under the direction of the attending physician. It is portable, being quite capable of being carried in an overcoat pocket.

The inventor finds in practice that it has far exceeded his expectations, inasmuch as by its use he gets greater tonic effects than from the employment of both faradism and massage separately. It fulfils most of the requirements of the induction current in general practice and every-day cases. As the current is generated by motion, no acids or liquids of any kind are necessary. The instrument is at all times ready for use, a matter that will be appreciated by all who use electricity.

This treatment has been used with great success in cases of nervous exhaustion, debility, neuralgia, rheumatism, paralysis, &c., and we are informed that it is recommended by the medical profession generally. —*Scientific American.*

On the Application of Electric Motors.—By M. G. Trouvé.—I had the honour of submitting to the Academy, in its session July 7th, 1880, a new electric motor, founded on the excentricity of the play of a Siemens' coil. By successive studies, which have permitted me to reduce the weight of all the parts of the motor, I have succeeded in obtaining the following results, which appear to me worthy of notice:—

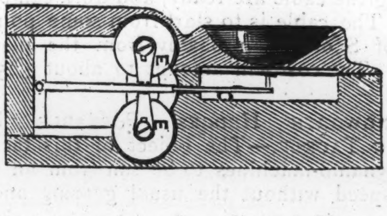
A motor, weighing 5 kilos., impelled by 5 Planté's secondary elements, producing an effective work of 7 kilogrammetres per second, was placed on the 8th of April upon a tricycle, the weight of which, including the rider and the batteries, reached 160 kilos., and impelled it at the rate of 12 kilometres per hour.

The same motor placed on May 26th upon a boat $5\frac{1}{2}$ metres in length, by 1·20 metre in width, and containing three persons, gave it a speed of $2\frac{1}{2}$ metres (per second ?) whilst descending the Seine to the Pont Royal, and of $1\frac{1}{2}$ metre on returning. The motor was worked by two batteries, each of six bichromate elements, and the propeller was a screw with three blades.

On June 26th I repeated the experiment on the calm water of the upper lake in the Bois de Boulogne, with a screw of four blades of 0·28 metre in diameter, and twelve flat Bunsen elements, of Rhumkorff's modification, charged with 1 part hydrochloric acid, 1 part nitric acid, and 2 parts water, in order to reduce the escape of hypo-nitric vapours.

The speed at the outset, as measured by an ordinary log, was exactly 150 metres in 48 seconds, or rather more than 3 metres per second; but after working for three hours it fell to 150 metres in 55 seconds. After five hours' action the speed was still 2·30 metres per second, as the 150 metres were traversed in 65 seconds. —*Comptes Rendus.*

A PATENT (No. 244,442, dated Sept. 10th, 1880) has been taken out in the United States by Mr. F. K. Fitch for the telephone represented by the figure.



The instrument consists of a polarised Siemens' armature, operated upon by the opposite poles of an electromagnet, the armature being connected to the centre of a diaphragm.

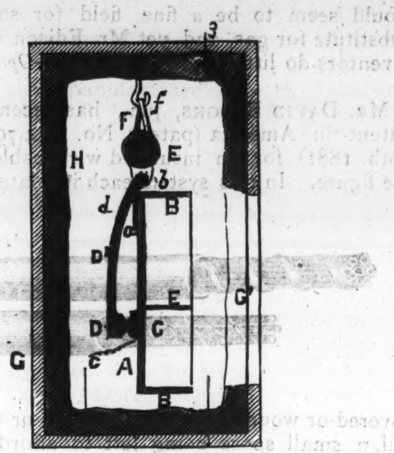
A COMPANY is in process of formation, consisting of Englishmen, French, Norwegians, and Danes, with the object of laying a cable, by way of the Faröe Islands, to Iceland.

A DEPUTATION from Ramsgate, consisting of Mr. Hobbs, Rev. Mr. Gilmour, and other gentlemen, waited upon Sir Thomas Brassey, at the Admiralty, on the 19th ult., and presented a petition bearing 10,000 signatures in favour of telegraphic communication being established between lighthouses and the shore, to be used in case of storms. Sir Thomas Brassey promised attention to the representations made to him.

THE United States Underground Telegraph Company has laid an experimental series of 72 wires, extending from the head-quarters of the Fire Department in Mercer Street to police head-quarters in Mulberry Street. The wires are laid in long wooden boxes covered with a preparation of silica and other substances designed to exclude dampness and secure perfect insulation. It is said that if the present experiment is successful the system will be extended so as to include the police-stations, engine-houses, and fire-alarm boxes.

THE Polytechnic Institution, Regent Street, which was founded in 1831 for the exhibition of novelties in science, has been closed.

THE Superior Committee of the Electric Exhibition, with M. Teisserenc de Bort in the chair, have handsomely decided that, though there are 1,200 French exhibits and but 500 in all the foreign sections, the international jury shall consist of French and foreign members in equal numbers. The foreign sections are requested to propose jurymen in proportion to their exhibits. The minimum number of the jury is fixed at 100. The committee will place at the disposition of the jury 50 gold medals, 200 silver, and 500 bronze.



THE figure represents a telephone patented (patent No. 244,638, dated Jan. 5th, 1881) in the United States by Mr. W. Main. The apparatus consists of an acoustic vibrator formed of a plate of resonant wood suspended from above so as to be perfectly free to swing backwards and forwards, or to vibrate. The transmitting arrangement consists of a resistance varying electrode in combination with a second contact, the two contacts being pressed tightly together by the force of gravity, owing to the curved shape of the electrode arm.

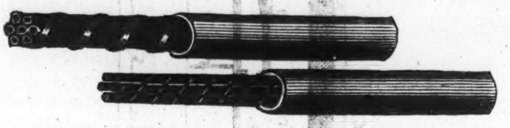
FIRED BY ELECTRICITY.—An interesting illustration of the danger attending the manufacture of some kinds of rubber goods was shown in the origin of the recent fire which occurred in the Ætna Rubber Mills, at Jamaica Plains. The cement which fastens the seams of rubber coats is largely made of naphtha. The mere act of lifting a piece of rubber cloth from a pile of half-a-dozen similar ones, cut for garments, developed so much electricity that a spark was observed to escape. It came in contact with the naphtha cement, or with gases arising from it, and instantly the whole room was in a blaze. Fortunately the fire was extinguished without destroying the mill, the loss being only about a thousand dollars. It is not known that anything can be done to prevent the occurrence of another accident of precisely the same kind, whenever all the atmospheric conditions are favourable. One would suppose, however, that a certain degree of dampness would remove all danger from that source.—*Commercial Bulletin.*

THE Technical Committee of the Electrical Exhibition, under the presidency of the Minister of Posts and Telegraphs, has urged M. Berger, the Commissary General, to organise a series of elementary lectures, illustrated by experiments, on some of the chief electrical inventions exhibited.

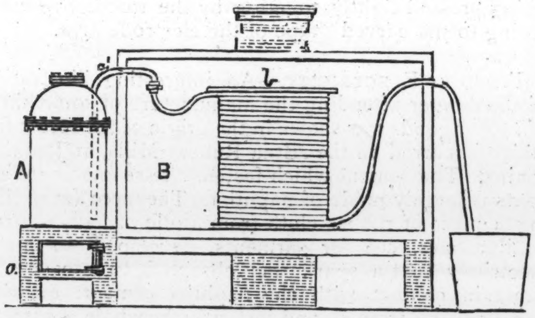
IN Canada there are 35,000 miles of telegraph-wires; there is one office to every 2,430 persons, while in this country there is only one office to every 5,860 persons.

IF Mr. Edison intends, as he now promises, to illuminate 500 houses in this city with his electric light by the 1st October, the gas companies do not seem to be scared. It has been recently shown that New York now pays two and two-third times as much for gas as London, two and a-half times as much as Ghent, twice as much as Amsterdam, Berlin, or Brussels, and half as much again as Paris, Lyons, or Marseilles. While coal sells for five dollars a ton in London, and four dollars in Philadelphia, the price of gas in the latter city is three times what it is in London. Here, then, would seem to be a fine field for some acceptable substitute for gas, and yet Mr. Edison and his brother inventors do little more than talk.—*Operator*.

MR. DAVID BROOKS, jun., has recently taken out a patent in America (patent No. 244,790, dated May 20th, 1881) for an insulated wire cable as shown by the figure. In this system each insulated wire is partly covered or wound with a thin ribbon or wire of metallic foil, a small space being left to afford access of the insulating fluid to the insulation of tissue, cotton, or other fibre. A number of such wires are bound by a metallic strip and introduced into a lead pipe, or the binding-wires are omitted and wires introduced unbound. Induced currents are thus conveyed away.



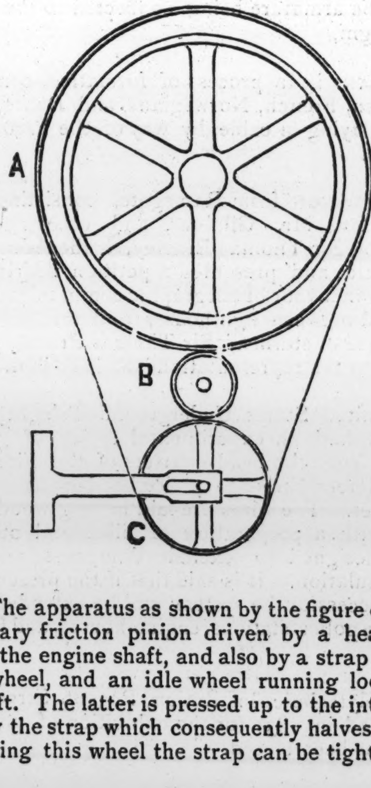
IN connection with the oil insulation system, Mr. Brooks has also taken out a patent (No. 244,791, dated Nov. 29th, 1880) the subject of which is an air-tight vessel, A, heating apparatus, *a*, pipe, *a'*, and chamber, B, containing the conductor or pipe, combined as shown, whereby the pressure created within said vessel by the volatilisation of a portion of the insulating fluid forces the fluid material into the conductor in the chamber, B, and insulates the wires.



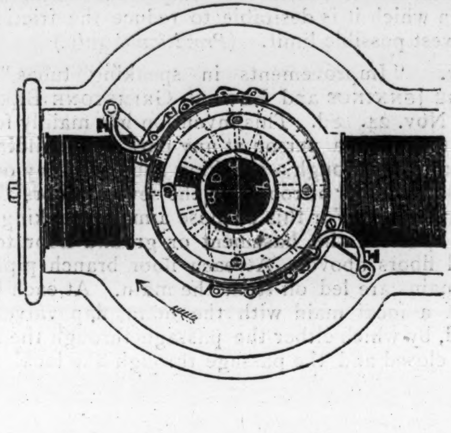
M. SAMUEL, of Ghent, has brought before the Belgium Academy a method of registering telegraphic signals received through the mirror galvanometer (*Bull.*, No. 5). On the screen receiving the light are fixed two selenium elements, one to the right, the other to the left. When either is illuminated its conductivity of course increases, and it acts as a relay on an electro-magnet, which causes a Morse dot or dash to be marked on paper. There are two local batteries, one having two circuits, which pass through the selenium pieces and the electro-magnets, while the other is for the electro-chemical writing. In this latter, a band of paper saturated with iodide of potassium passes continuously over a small copper cylinder which is connected with one pole of the second battery. Above the paper are the ends of the armatures of the electro-magnets; to one is attached a vertical platinum rod, to the other a small triangle with platinum base (horizontal). The rod and triangle are connected, through the armatures, with the other pole of the second battery, and they press the paper band on the cylinder each time the armatures are attracted, giving a dot or a dash as the case may be. The dashes, instead of being longitudinal, are at right angles to the length. If the ordinary lamp of the galvanometer be replaced by sunlight or limelight, the electro-magnets (M. Samuel points out) may be actuated directly without use of a galvanometer relay, Bell's selenium elements having an average resistance of only 150 ohms in sunlight, and 300 ohms in darkness.—*Nature*.

THE ICELAND CABLE.—With reference to the proposed telegraph cable to Iceland, the *Standard* correspondent at Copenhagen states that he had an interview with M. Madsen, the telegraph engineer, who laid most of the submarine Chinese and Japanese cables, and who is now the consulting engineer and superintendent of the Great Northern Telegraph Company. M. Madsen assures him that all the calculations and plans for laying the cable are ready, and work can be at once begun. The cable is to start from some point in the North of Scotland, probably from the place called Thurso. The cost will amount to about £250,000.

KILLINGWORTH HEDGES' PORTABLE ELECTRIC LIGHTING TACKLE.—The object of this tackle is to enable dynamo-machines to be run from an engine at a high speed without the usual gearing and without noise. The apparatus as shown by the figure consists of an ordinary friction pinion driven by a heavy pulley fixed on the engine shaft, and also by a strap encircling the fly-wheel, and an idle wheel running loose on its own shaft. The latter is pressed up to the intermediate wheel by the strap which consequently halves the work; by lowering this wheel the strap can be tightened.



THE figure shows a dynamo-electric machine patented (patent No. 245,260, dated May 23rd, 1881) in the United States, by Mr. W. Hutchinson. The apparatus is described as being an improvement on machines of the Pacinotti type, and consists in the employment of commutator-brushes so located relatively to the bobbins that the bobbins which are entering the field are short-circuited, while the currents are collected from those which are leaving the field. The improvements in the armature-core consist in constructing it of segmental plates with insulated overlapping ends and securing the sections together by non-magnetic rods or bolts; also in the peculiar form of the segmental plates.



THE POSTAL AND TELEGRAPH SERVICES.—Mr. G. Stewart Macliver, M.P., has given notice of the following motion:—"To move, early next Session, for a Select Committee to inquire into the working and management of the Postal and Telegraph Services, with a view to ascertain whether increased facilities and lower rates cannot be afforded; and also to consider and report on the relationship of the letter-carrying and telegraph services to each other, and the best means of securing efficiency in both branches, having regard to their constantly-increasing importance in their bearing on social and commercial life."

New Patents—1881.

3362. "Improvements in electric lamps and apparatus connected therewith, part of which improvements is also applicable to other electrical purposes." J. HOPKINSON. Dated August 3.

3369. "Working gear and appliances used in electric lighting." K. W. HEDGES. Dated August 3.

3380. "Improvements in apparatus for detecting and recording the passage or stoppage of an electric current through a conductor, applicable for telephones and other electric apparatus, and for purposes for which ordinary tell-tale clocks are now applied." W. D. THOMPSON. (Communicated by J. A. Pel.) Dated August 4.

3384. "Improvements in electrically actuated indicators and in transmitters for controlling the operation of the same." J. C. MEWBURN. (Communicated by C. H. Pond.) Dated August 4.

3386. "An electric organ." W. F. SCHMOELE and A. MOLS. Dated August 4.

3388. "Improvements in continuous underground pipes and in methods of forming and laying the same for telephonic and telegraphic wires." C. DETRICK. Dated August 4. (Complete.)

3394. "Means or apparatus for generating electric currents and for producing motion by electricity." ST. G. LANE FOX. Dated August 5.

3400. "Electric machines or apparatus for generating electricity." J. H. JOHNSON. (Communicated by J. B. J. Mignon and S. H. Rouart.) Dated August 5.

3402. "Improvements in electric lamps and in the manufacture of carbons for the same, and in apparatus employed in such manufacture." J. H. JOHNSON. (Communicated by J. B. J. Mignon and S. H. Rouart.) Dated August 5.

3404. "Apparatus or appliances for automatically lighting electric candles." E. G. BREWER. (Communicated by A. G. Desquiens.) Dated August 5.

3405. "Telephonic and telegraphic apparatus." T. A. CONOLLY. Dated August 6.

3409. "An improved method and apparatus for regulating the dynamical production of electricity. G. WESTINGHOUSE. Dated August 6.

3412. "An improved fluid to be used in galvanic batteries." T. COAD. Dated August 6.

3435. "An improvement in electric lamps operating by incandescence." F. WRIGHT. Dated August 8.

3437. "Electric lamps operating by incandescence." F. WRIGHT. Dated August 8.

3441. "Improvements in and appertaining to apparatus for generating electricity and means for utilising the same in producing the electric light." R. R. MOFFATT and S. CHICHESTER. Dated August 9.

3455. "Improvements in electric lighting and in the apparatus employed therein." W. E. HUBBLE. (Communicated by A. F. W. Partz.) Dated August 9.

3456. "Improved electrical apparatus for lighting and other purposes." W. R. LAKE. (Communicated by A. L. Arey.) Dated August 9.

3463. "An improved form of chain for protecting submarine telegraph cables and for connecting them with floating vessels, also other appliances to facilitate establishing telegraphic communication with lightships." F. R. LUCAS. Dated August 10.

3464. "An electric brake." S. VON SAWICZESKI. Dated August 10.

3472. "Construction of dynamo-electric machines." E. J. HARLING and E. HARTMANN. Dated August 11.

3473. "Improvements in electric lamps, part of which improvements are applicable to other purposes." E. J. HARLING and E. HARTMANN. Dated August 11.

3483. "Electrical distribution systems." E. G. BREWER. (Communicated by T. A. Edison.) Dated August 11.

3485. "Generating and applying electricity." J. L. PULVERMACHER. Dated August 11.

3509. "Electrical interruptors." P. ULLATHORNE. Dated August 12.

3519. "Means or apparatus employed in lighting gas by electricity." B. J. B. MILLS. (Communicated by L. A. W. Desruelles and G. J. A. E. Bourdoncle.) Dated August 13.

3538. "Improvements in the method and apparatus for registering by means of electricity the number of picks woven per inch in looms for weaving." J. PORRITT. Dated August 15.

3539. "Electrical apparatus chiefly designed for telegraphic and telephonic purposes." W. R. LAKE. (Communicated by C. Williams, F. W. Harrington, and T. W. Lane.) Dated August 15.

3555. "An improved means or apparatus for conveying messages and articles of property from ships." H. REDKNAP. Dated August 16.

3559. "Improvements in electric lighting and in the means or apparatus employed therein." C. W. HARRISON. Dated August 16.

3599. "Electric lamps." C. LEVER. Dated August 18.

3635. "Production of the electric light." T. TUBINI. Dated August 20.

3650. "Electric lamps." G. PFANNKUCHE. Dated August 22.

3652. "An improved coiling machine." C. L. CLARKE and J. LEIGH. Dated August 22.

3655. "Division and regulation of electric currents." R. E. DUNSTON and G. PFANNKUCHE. Dated August 22.

3668. "Electric lighting apparatus." W. R. LAKE. (Communicated by T. A. Conolly.) Dated August 23.

3679. "Electric light regulators." S. PITT. (Communicated by S. J. Burrell.) Dated August 23.

3696. "Electric magnetic clocks and batteries for the same and other purposes." C. SHEPHERD. Dated August 24.

3711. "Electric lamps." F. H. F. ENGEL. (Communicated by C. H. F. Müller.) Dated August 25.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1880.

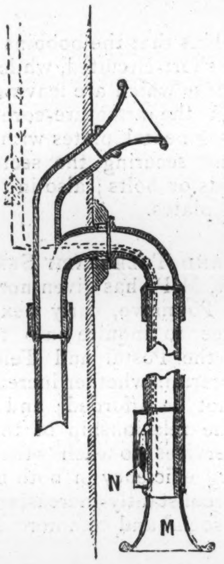
1397. "Electric lamps," &c. CHARLES DENTON ABEL. (A communication from abroad by Franz Krizik and Ludwig Piette, both of Pilsen, in the Austrian Empire.) Dated April 6. 6d. Relates to the lamp described in the No. of the Journal for Dec. 15, 1880.

4564. "Thermometers and barometers." EDGAR EDMONDS. (A communication from abroad by Otto Koch, of Berlin, and August Eichhorn, of Coethen, Germany.) Dated Nov. 6. 2d. The object of this invention is a thermometer, in the scale of which platina-wires are inserted in such a way that the ends just enter the inside of the thermometer tube, so that the platina metal comes in contact with the mercury whenever it is expanded by heat. Each platinum wire is connected to a key; and by pressing down these keys the circuit is closed upon a transverse wire in connection with an alarm bell and a battery, so that by putting down one key after the other, it can easily be ascertained which is the utmost key that closes the circuit, and thus the height of the mercury can be found. (*Provisional only.*)

4782. "Automatically counting the number of letters impressed with obliterating stamps," &c. HENRY FERGUSON and HARRY ROBERT KEMPE. Dated Nov. 19. 6d. Relates to the apparatus described in the No. of the Journal for August 1st.

4851. "Current meters." HENRY LAW. Dated Nov. 23. 2d. The meter is so constructed that the shaft or axle which is put into motion by the current, imparts its motion to a vertical shaft or axle, inclosed in a tube closed at its upper extremity, the vertical shaft being carried to the upper part of the tube, and an arrangement being there adopted by which at one point in its revolution it completes an electric circuit, which gives a signal to the observer above the surface of the water, or records the number of times that the circuit is so completed. By this arrangement the air in the vertical tube not being able to escape prevents the water reaching its upper extremity and interfering with the perfect insulation of the electric current, and the use of any kind of stuffing box is rendered unnecessary, a matter of considerable importance in an instrument in which it is desirable to reduce the friction to the lowest possible limit. (*Provisional only.*)

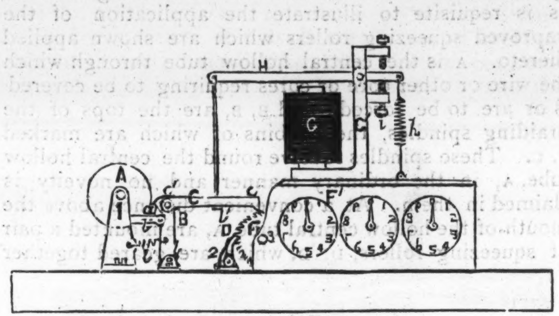
4887. "Improvements in speaking tubes," &c. GEORGE JENNINGS and EDWARD GRIMSTONE BREWER. Dated Nov. 24. 8d. This invention has mainly for its object to enable a person at any part of a building to communicate through a speaking tube with any one or other of a number of rooms on the several floors above, and *vice versa*. For this purpose a main speaking tube is led up from the basement or ground floor to the several floors above. At each floor branch pipes or local mains are led off from the main. At each junction of a local main with the main, flap valves are applied, by which either the passage through the main can be closed and the passage through the local main opened, or *vice versa*. In the same way branches are or may be led off from the local mains on each floor to different rooms on such floor, and valves are similarly applied at the junctions of the local mains and branches. Ordinarily the passage through the main is open from end to end, and the passages from it to the local mains closed, and similarly the local main is open from end to end, and the passages from it to the branches closed. The several valves are normally held in proper position by light springs or weights to keep the mains open and the branches closed, as above described. Together with the above apparatus is combined electrical apparatus, by which either a person at the end of any one of the branches can give a call signal to the terminal end of the main pipe and open communication from his branch speaking tube to the terminal end of the main speaking tube, or *vice versa*, that a person at the terminal end of the main speaking pipe can give a call signal to persons at the end of any one or other of the branches for them to open communication through the speaking tube with that branch. The general arrangement is shown by the figure. At the extremity of each speaking tube is a length of flexible tubing, L, carrying



a mouthpiece, M, which hangs downwards. Through the tube are led two insulated wires; the ends of both wires are brought to a contact apparatus, N, carried by the mouthpiece. For this contact apparatus is used a short glass tube partially filled with mercury. The end of one wire is led through one end of the tube, and of the other wire through the other end of the tube. The tube stands vertically when the mouthpiece is hanging downwards, and the mercury then in the bottom of the tube is not in contact with the end of the wire which passes down through the top of the tube. When, however, the mouthpiece is turned upwards by any person so that he may speak through it, the mercury drops to the opposite end of the tube, and is then in contact with the ends of both wires, and puts them in electrical connection one with the other. One wire is led away to one of the main conducting wires from the battery, and the other is led through the coils of the electro-magnet of the valve apparatus at the junction of that speaking tube with the main, or if the speaking tube is a branch, the wire is led through the coils of the electro-magnet of the valve apparatus at the junction of the branch with the local main, and also through the coils of the local magnet of the valve apparatus at the junction of the local main with the main, and is then connected to the main return wire. In this way when the mouthpiece at the end of any speaking tube is turned upwards a circuit is completed from the battery through the contact apparatus, and acts upon such of the valves as required to open communication from that speaking tube to the basement, and at the same time shuts off all communication through the other tubes. When the speaking tube at the further end is lifted the bell is short-circuited and stopped from ringing.

4952. "Furnaces for metallurgy of copper," &c. ALEXANDER MELVILLE CLARK. (A communication from abroad by Jules Garnier, of Paris, France.) Dated Nov. 27. 2d. Has partly for its object to improve or reduce the electrical conductibility of copper according to the purpose for which it is to be used. It is known that copper containing a small proportion of oxygen is a poor conductor of electricity, and this invention consists in eliminating the last trace of oxygen contained in the copper, and thus greatly improving its conductibility by adding to the copper in the reverberatory furnace, just before tapping, phosphorus in the form of phosphide of copper or other suitable phosphorus compound in proper proportion to eliminate the excess of oxygen.

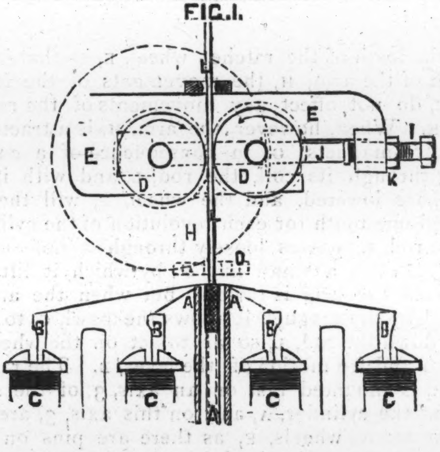
5004. "Measuring and recording electric currents," &c. JOSEPH WILSON SWAN. Dated December 1. 6d. This invention consists of a means of measuring electric currents for electric lamps and other purposes. A clock causes a small ratchet to move backwards and forwards continually and to actuate a ratchet wheel connected to a counter. The ratchet is also connected to an electro-magnet, which, when excited by the current, allows the ratchet to gear into the ratchet wheel; but when the current ceases, the ratchet is lifted out of gear by the armature of the electro-magnet rising. In the figure, A is a cylinder carried in suitable bearings, 1, and maintained in continuous rotation by a clock or other means at a fixed rate, say, for example, one revolution in fifteen minutes. Upon this cylinder are arranged a number of pins, *a* (according to the number of lights to be registered). Each of these pins acts upon a certain set of levers; one of these pins and sets of levers are shown in the figure. A lever, B, hinged at *b*, and kept against a fixed stop, b^1, by means of a spring, b^{11}, has attached to it at c^1 another lever or pawl, C, in such a manner that its own weight will cause its extremity, *c*, to engage with the teeth of the ratchet wheel, E. If now the pin, *a*, on the cylinder, A, acts on the lever, B, the pawl will thereby be caused to propel the ratchet wheel, E, to the extent of one tooth, a detent, D, acted upon by a spring, 2, serving to retain the ratchet wheel, E, in position until the same is propelled again by the pawl, C. The ratchet wheel, E, is connected with a suitable counting mechanism, F, so as to transmit motion to the same, as will be well understood. An electro-magnet, G, the coil of which is in circuit with one of the lamps, is placed under the arm, H, which is formed of iron and mounted on an iron bracket, G^1, constituting one of the poles of the magnet. The arm, H, before the passage of a current is drawn against the adjusting screw, *i*, by the spring, *h*, and thereby lifts, by means of a wire or rod, L, the pawl, C, out of the teeth of the ratchet wheel, E, so that in this position of the arm, H, the movements of the levers, B and C, do not affect any movements of the ratchet wheel, E. When, however, the arm, H, is attracted by the electro-magnets, G, in consequence of a current passing through its coil, the rod, L, and with it the pawl, C, are lowered, and the wheel, E, will then be propelled one tooth for each revolution of the cylinder, A. The rod, L, passes loosely through a hole in the pawl, C, and has a small nut, b^1, by which it lifts the pawl when the arm is raised; but when the arm is attracted by the magnet it allows the pawl, C, to slide up and down the rod, L, so as to act on the wheel, E, by the to-and-fro motion of the lever, B. The ratchet wheel, E, is mounted fast on an axis, 3, of the same length as the cylinder, A, and on this axis, 3, are also keyed as many wheels, E, as there are pins on the cylinder, A. For each wheel there are the levers, B and C, and also arms, H, and electro-magnets, G. The coils of the latter are each in circuit with a different lamp, so that the number of circuits in action will cause the same number of teeth of wheels, E, to be propelled during each revolution of the cylinder, A, one counting mechanism being common to the whole.



5022. "Indicating the heating of bearings in steam engines," &c. HENRY WILLIAM WIMSHURST. Dated Dec. 2. 2d. The object of this invention is to provide a sure means for attracting attention to the bearings so soon as they are heated beyond the desired limit. A plug or stopper of fusible metal or solid paraffin, or of their equivalents, which will melt, say, at 150° Fahrenheit, more or less, according to the proportions of the alloy used, is inserted in or attached to any convenient part of the journals or working parts of the engine which are liable to get heated by friction. Against this plug or stopper one end of a weighted bell-crank lever rests in such a manner, that, directly the desired limit of temperature is overstepped, the plug, by its fusion or fracture, will liberate the said lever or spring, and allow it to act upon a gong, operate a steam whistle, establish electrical contact, or give any other desired indication that the bearings are heated improperly. (*Provisional only.*)

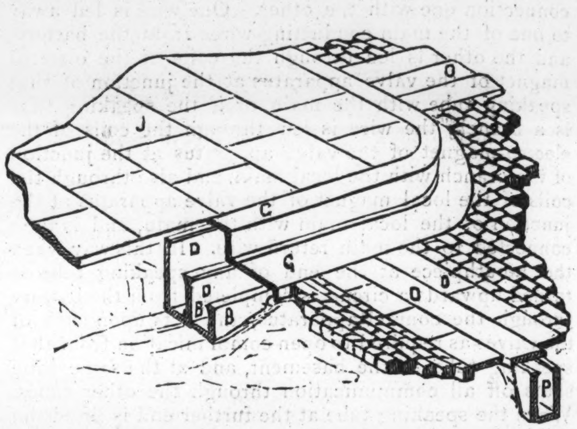
5237. "Machinery for braiding, lapping, &c., telegraph wires," &c. WALTER TWISS GLOVER and GEORGE FREDERICK JAMES. Dated December 14. 6d. Relates to improvements in machinery for braiding, lapping, or coating telegraph wires, crinoline steel, engine packing, or other cores, with textile or other material. The invention consists of an arrangement of mechanism for forcing the iron, copper, or other metallic wire, requiring to be coated or covered with textile or other covering material, through the braiding or other machine employed, by means of a pair of squeezing rollers. Fig. 1 represents a side sectional view of so much of the top of the braiding spindles and hollow central tube of a braiding machine as is requisite to illustrate the application of the improved squeezing rollers which are shown applied thereto. A is the central hollow tube through which the wire or other core or cores requiring to be covered is or are to be forced; and B, B, are the tops of the braiding spindles, the bobbins of which are marked C, C. These spindles revolve round the central hollow tube, A, in the ordinary manner, and no novelty is claimed in them. At a convenient distance above the mouth of the hollow central tube, A, are mounted a pair of squeezing rollers, D, D, which are geared together in the frames, E, by the spur wheels, G, and revolving motion is communicated to these rollers at the desired speed and in the direction of the arrows by the worm wheel, H, affixed upon one of their axes. These rollers, D, D, are adjustable in their distance from each other by means of the set screws, I, and spring, J, the set screws, J, being provided with lock nuts, K, to insure their remaining stationary. The action of this mechanism is as follows:—The end edge of the wire or other material, L, requiring to be covered or coated is first passed between the feeding rollers, D, and then introduced into the mouth of the central tube, A. The machinery being now set in motion, the feeding rollers, D, force the wire, L, down the tube, A, whilst the braiding spindles simultaneously cover or braid the same with textile or other material drawn off the bobbins, and if desirable to introduce yarn of textile material or lengths of india-rubber or other material to form an additional coating between such wire or central core and the outer braiding material, it is only requisite to employ a central guide piece, O, with holes surrounding the central opening, through which holes the additional coating material is guided in being drawn off the creel or bobbins.

FIG. I.



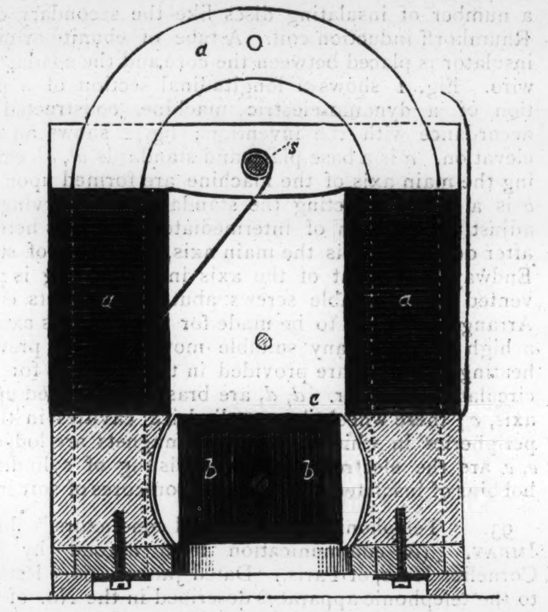
1881.

39. "Street curbs and gutters for the reception of telegraph wires." HERBERT JOHN HADDAN. (A communication from abroad by John D. Townsend, America.) Dated January 4. 4d. The object of the invention is to so construct the curbs and gutters of streets that the space now occupied by the ordinary curbstones and gutters may be utilised for the reception and preservation of telegraph, telephone, and other wires. J represents the pavement or sidewalk, C, C the curb, and G the gutter place or piece, cast in piece with the curb plates or pieces, C, C. The sides of the cases and cover are made with flanged projections, D and *f*. The flanges, D, receive the screws or bolts, E, by means of which the cover is held in place, while the exterior flanges, *f*, serve to more effectually exclude dirt and moisture. The gutter plate, G, is provided with an exterior flange against which the paving stones are placed. At street crossings the space underneath the flagging will be occupied by the tranverse cases, P, which open into the main conduits, and may extend underneath the side walk to adjoining buildings, so as to carry the conductors directly into the buildings. These transverse conduits may be carried under the side walks at any point. The crosswalks are covered by the plates, O, having the flanges, *f*; the ordinary cross walk stones being shown at O'.

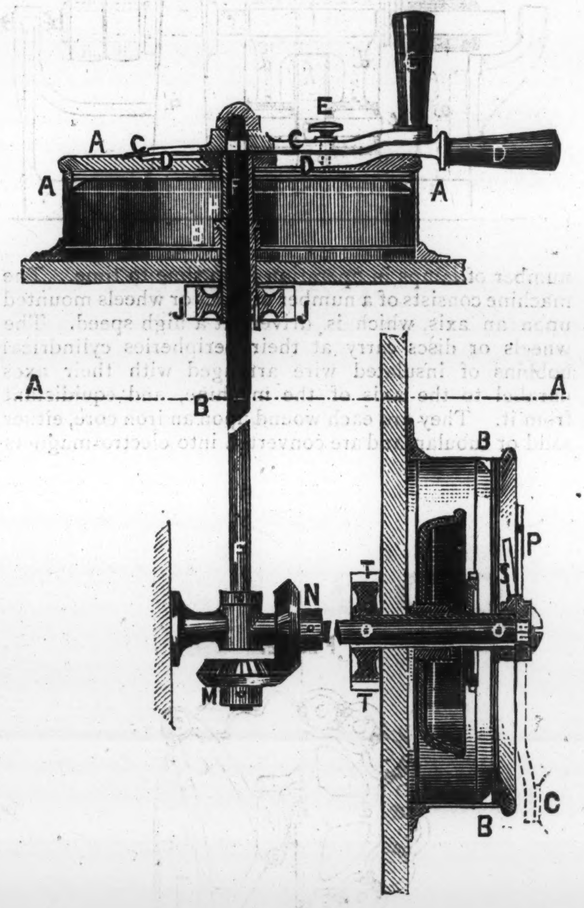


48. "Generating and utilising electricity for lighting," &c. W. R. LAKE. (A communication from abroad by Eugène Etève, of Paris.) Dated Jan. 4. 6d. Relates chiefly to that class of magneto-electric machines or apparatus, in which a coil or bobbin rotates before the poles of a magnet, and is designed to furnish a source of electricity which will in a small space develop a current sufficiently strong to produce light to actuate any apparatus, or to serve for igniting gases, essences, or volatile bodies, and thus to form an electric igniting apparatus. The invention also comprises improvements in apparatus for developing electric light. The apparatus consists of a horse-shoe magnet, *a*, composed of a suitable number of tempered and magnetised steel plates connected by one or more rivets; the arms of the said magnet are surrounded by a suitable number of layers of perfectly insulated copper wire. These arms carry at their ends two blocks or pieces of iron, forming open and recessed magnetic poles, between which a single coil, *b*, rotates. The said coil (mounted on an axle, *c*, and actuated by wheels), constitutes one of the essential features of the said invention, and its special characteristic is that it presents only two induction poles, and therefore only two points of resistance, whatever the power or size of

the machine may be. For the purpose of rendering this proportionately small coil sufficiently effective, the same is constructed of a varying number of plates, according to the power that is to be developed, the said plates being placed one above the other, and so connected as to form as it were a whole. The current developed in this coil is sent into two friction brushes by means of a small commutator of ordinary construction. The wires are so arranged that the current produced by the rotation of the coil in the field of the magnet returns into the coils of the said magnet to increase its magnetism. This arrangement admits the use of magnets of inferior quality without risk of their demagnetisation.



56. "Mechanical telegraphs." WILLIAM CHADBURN. Dated Jan. 5. 6d. Relates to an arrangement of shafting in combination with bevelled wheels, and spur wheels, and indicator dials, and pointers, the combined arrangement constituting a mechanical telegraph for transmitting messages or orders, and replying to same, and is particularly applicable as a ship telegraph for transmitting messages from the bridge to the engine room or from the bridge to the steersman, or for other like purposes. The figure is a vertical sectional elevation of the instruments and operating gear. A is the transmitting instrument, and B the receiving instrument, the dials of which are identical, one section being devoted to "ahead," with the usual points "stand by," "slow," "half speed," "three quarters speed," "full speed," and the other section being devoted to "astern," with the usual points "stand by," "slow," "half speed," "full speed." The sections are separated from each other by the points "stop" and "revolutions." The "ahead" section is supplemented by two concentric series of numerals, one series representing units, and the other series representing tens. The dials of the instruments, A and B, being thus arranged, they are provided with two pointers, C and D, arranged to cover each other, and be held in such position by the pin, E, in the instrument, A, for ordinary working, when indicating "ahead" and "astern," and the ordinary indications only, and by removing the pin, E, to work separately when indicating revolutions; thus when the pin, E, is removed, one pointer may be placed to stand at the tens, say 60, and the other pointer may be placed at the units, say 5, thus showing 65 as the revolutions required. The essential feature of the invention is the way in which the transmitting instrument, A, is geared with the receiving instrument, B, so that whatever position the pointers, C, D, of the instrument, A, may be placed in, the pointers, S, P, of the instrument, B, would assume the same position. The gear consists in mounting the unit pointer and handle, D, of the transmitting instrument, A, upon a hollow shaft, boss, or sleeve, H, which is loosely mounted over the shaft, F, which carries the tens pointer and handle, C. The same arrangement is observed in the receiving instrument, B, namely, the unit pointer, S, is mounted upon the hollow shaft or sleeve, R, and the tens pointer, P, is mounted upon the central shaft or spindle, O. The connections are made by means of a duplicate system of shafting and bevel wheels, namely, the shaft, F, works the bevel wheels, M, which operates the bevel wheel, N, and the shaft, O, and thus communicates motion from the tens pointer, C, of the instrument, A, to the tens pointer, P, of the instrument, B, and the hollow shaft, H, communicates motion to the toothed wheels, J, K, and to the shaft, L, which through the bevel wheels, W, X, the shaft, V, the toothed wheels, U, T, and the hollow shaft, R, communicates motion from the units pointer, D, of the instrument, A, to the units pointer, S, of the instrument B. It will be seen that the primary and terminal connections between the hollow shaft, H, and the hollow shaft, R, are made by means of the toothed wheels, J, K, and U, T. By the arrangement, the units and tens pointers may be worked independently of each other,



so as to be adapted for revolution indicators (or independent telegraphs, such as for working twin engines), or when fastened together by the pin, E, the pointers will all work conjointly, acting as an ordinary indicator, or, if desired, by placing a handle, as shown in dotted lines, on the pointer, P, of the instrument, B, the instruments and gear will act as a reply telegraph.

78. "Dynamo-electric machines for electric lighting." J. E. H. GORDON. Dated Jan. 6. 6d. Has for its object improvements in dynamo-electric machines for electric lighting. The improved dynamo-electric machine is designed to maintain a large number of independent lights; also so that the efficient working of the machine and the maintenance of the lights may not be interfered with by increasing or diminishing the number of lamps in operation from time to time. The machine consists of a number of discs or wheels mounted upon an axis, which is driven at a high speed. The wheels or discs carry at their peripheries cylindrical bobbins of insulated wire arranged with their axes parallel to the axis of the machine, and equidistant from it. They are each wound upon an iron core, either solid or tubular, and are converted into electro-magnets by permanent connection with a direct current exciting machine; the magnet coils may be combined in "series" or "quantity," or in whatever combination of them best suits the exciter used. The polarity of the magnets is such that the poles on each side of a given pole and the one opposite to it are of contrary polarity to itself. Between the wheels or discs other cylindrical bobbins of insulated wire are arranged, their axes are also parallel with the axis of the machine, and they are carried by stationary brackets fixed to the frame. They generally have cores, consisting preferably of a bundle of iron wires, though a slit tube might be used. When used for the production of high tension currents, such as are required for the inventor's iridium lamps, they are wound with fine wire. Each bobbin is divided by a number of insulating discs like the secondary of a Rhumkorff induction coil. A tube of ebonite or other insulator is placed between the core and the conducting wire. Fig. 1 shows a longitudinal section of a portion of a dynamo-electric machine, constructed in accordance with the invention; fig. 2 shows an end elevation. *a* is a base plate, and standards a^1, a^1, carrying the main axis of the machine are formed upon it; *b* is a stay connecting the standards, and serving to adjust the position of intermediate frames, as hereinafter described; *c* is the main axis, preferably of steel. Endway movement of the axis in its bearing is prevented by adjustable screws abutting upon its ends. Arrangements are to be made for rotating this axis at a high speed by any suitable motor, and to prevent heating, passages are provided in the bearings for the circulation of water. *d*, *d*, are brass wheels fixed upon axis, *c*; these wheels have cylindrical cavities in their peripheries in which the electro-magnets are lodged; *e*, *e*, are the electro-magnets consisting of cylindrical bobbins of insulated wire wound upon cores of soft iron.

FIG. 1.

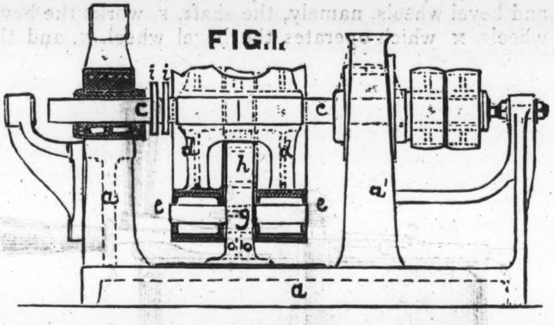
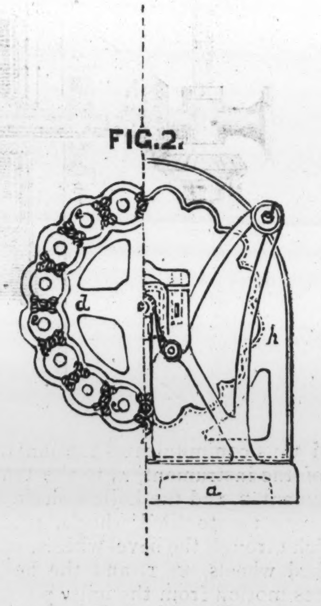


FIG. 2.



93. "Telephonic apparatus and conductors." JOHN IMRAY. (A communication from abroad by Dr. Cornelius Herz, of Paris.) Dated Jan. 8. 6d. Relates to the telephonic apparatus described in the No. of the TELEGRAPHIC JOURNAL for March 1, 1881.

108. "Converting heat into electricity." JOHN CARTER RAMSDEN. Dated Jan. 8. 2d. This invention consists of appliances by means of which heat is converted into electricity and conducted so as to form one main current, or divided and subdivided, thereby admitting the application of the current or currents to one or more points, applications, and uses. Apparatus and means for purpose aforesaid comprise a furnace within which the spliced or contact parts of plates, rods, or bars of metal (by preference iron and copper) are received, the other ends of such plates, rods, or bars continuing and extending beyond or outside the furnace, the external portion of each plate, rod, or bar being enclosed by open ended cylinders, or tubes of porcelain or other non-conducting medium of electricity and resistant of high temperatures. To the outer extremities of the plates, rods, or bars is attached a bar of metal such as bismuth, or other metal adapted for conveying electricity, and to each of these plates, rods, or bars is attached a wire, each pair of wires being continued, and the circuit closed or completed by any of the ordinary appliances according to the use to which the electricity is to be applied. (*Provisional only.*)

152. "Electric batteries." JOHN ALEXANDER LUND. Dated Jan. 12. 2d. An electric battery is formed of a cell or vessel containing an acid solution (preferably sulphuric acid) and with zinc lying in mercury at the bottom of the vessel for the one element, whilst for the other is used plates formed of a mixture of oxide of manganese and carbon. The mixed oxide of manganese and carbon element employed is made up of a central carbon plate with one or more plates of mixed oxide of manganese and carbon held to it on one or more sides, the plates being formed so as only to touch one another at top and bottom. Electrodes formed in this way are now commonly made. (*Provisional only.*)

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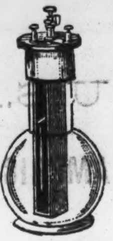

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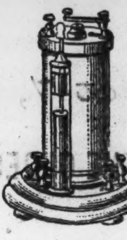

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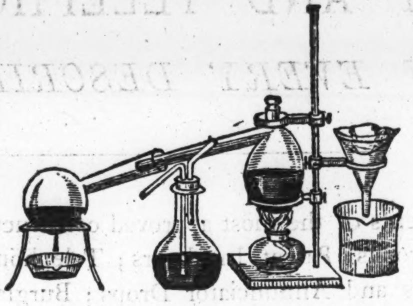

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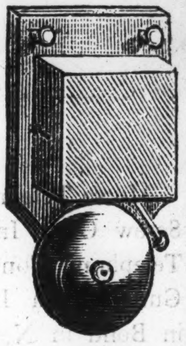

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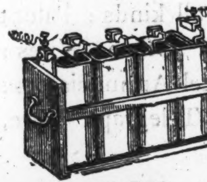

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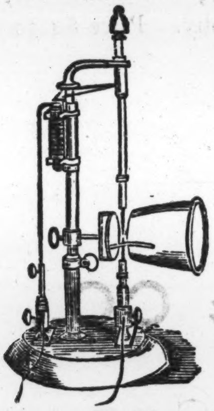

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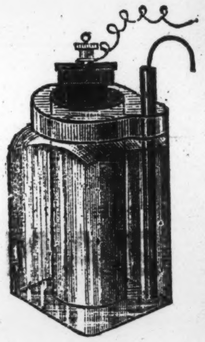

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